PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

VOL. VIII. JULY—DECEMBER, 1861. No. 66.

Stated Meeting, July 19, 1861.

Present, seven members.

Professor CRESSON, Vice-President, in the Chair.

A letter, accepting membership, was received from Prof. Andreas Wagner, dated Munich, June 1, 1861.

Letters acknowledging the receipt and also the transmission of publications were received from the Horticultural Society at Berlin, dated Feb. 18, 1861, from the Royal Society at Göttingen, dated Oct. 6, 1860, and from the Royal Bavarian Academy at Munich, dated Dec. 20, 1860.

Letters announcing the transmission of publications were received from the Zoologico-Botanical Society at Vienna (requesting correspondence), dated April 11, 1861, from the Royal Russian Academy, dated Feb. 28, 1861, from the Imperial Austrian Academy, dated Feb. 26, and April 16, 1861, and from the Rhode Island Society for the Encouragement of Domestic Industry, dated Providence, July 2, 1861. The last also calling attention to a notice of the offer of premiums by the Society for the production of flax cotton.

On motion, the following societies were ordered to be placed on the list of corresponding societies: the Zoologisch-Botan-

ische Gesellschaft in Wien (to receive both the Transactions and the Proceedings: the Transactions as far back as they can be furnished); the Offenbacher Verein für Naturkunde at Offenbach am Maine (to receive the Proceedings); and the Rhode Island Society for the Encouragement of Domestic Industry (to receive the Proceedings).

Donations for the library were received from the Academies at Berlin, Vienna, Munich, and Philadelphia; the Society and University at Göttingen; from the Institutes at Salem and Philadelphia; the Astronomical Society at London; the Geographical Society and Bureau des Ponts et Chaussées at Paris; from the Zoologico-Botanical Society at Vienna; the Horticultural Society at Berlin; the Natural History Societies at Offenbach and Bonn; the Zoological Society at London; the Asylums for the Insane at Hartford and Concord; the American Oriental Society at New Haven; the Rhode Island Society for the Encouragement of Domestic Industry; the publishers of the American Journals of Science, and of the Medical Sciences; the American Colonization Society; from Prof. Alexander, of Baltimore; Mr. Janney, of Virginia; Mr. M. C. Lea, of Philadelphia; Prof. Jan, of Paris; and M. Justin Robin, of Caen, in France.

The Secretary announced the death of Don Angel Calderon de la Barca, formerly Spanish minister at Washington, and a member of the Society, at San Sebastian, on the 31st of May last, aged seventy years.

The Librarian laid before the Society a copy of the Proceedings No. 65, just published.

A paper was presented for publication in the Transactions by Dr. Leidy, in behalf of the author, entitled "On the Geology and Natural History of the Upper Missouri," which on motion of Mr. Fraley was referred to a committee, consisting of Mr. Lesley, Dr. Leidy, and Dr. Bridges.

A paper was presented for publication in the Transactions by Dr. Genth, through the Secretary, in behalf of the author, Mr. Ernest Haüser, deceased, late member of the Geological Survey of New Jersey, being his original notes, with illustrations of the structure and composition of some of the principal

mines in Northern New Jersey. On motion of Mr. Fraley the paper was referred to the same committee.

A paper was presented for publication in the Transactions by the Secretary, in behalf of the author, Dr. Tafel, of St. Louis, entitled "Phonology, or the Science of Elementary Sounds," being Part I, or an independent Introduction to an exhaustive analysis of the English language, especially as to the history of its literal pronunciation. On motion of Mr. Fraley the paper was referred to Dr. Coates, Prof. Coppée, and Prof. Alexander of Baltimore.

Dr. Bache alluded to the subject of spectrum analysis, and the results obtained by the spectroscope.

Mr. Lesley referred to Dr. Volger's discovery of the homocercal fishtail in the roofing slate of Caub, on the Rhine, and its bearing upon the development theory.

Professor Cresson exhibited and described a phonogrammatic system of telegraphic symbols, invented by Dr. Charles M. Cresson.

Pending nominations Nos. 423 and 424 were read.

The Librarian exhibited copies of the first division of the Catalogue, Class I, pp. 16–68, just printed.

And the Society was adjourned.

Stated Meeting, August 16, 1861.

Present, five members.

Judge SHARSWOOD, Vice-President, in the Chair.

A letter, accepting membership, was received from Prof. D. Hyrtl, of Vienna, dated July 5, 1861.

A letter, resigning membership, was received from Dr. John J. Reese, of Philadelphia, dated August 12, 1861.

A letter, announcing a donation for the Library, was received from the Astor Library, dated July 29, 1861.

Letters acknowledging the receipt of publications were re-

ceived from the R. I. Geological Institute and R. I. Geographical Society of Vienna, dated Oct. 1860; from the A. Antiquarian Society, dated Worcester, Aug. 9; the Botanical Society of Canada, dated Kingston, Aug. 9; the Connecticut and New Jersey Historical Societies, dated Aug. 9, 1861.

Donations for the Library were received from the Holland Society at Harlem; the Royal Astronomical Society at London; the Astor Library; the New York State Library and State University; the Philadelphia Academy of Natural Sciences, and publishers of the Medical News; the Smithsonian Institution, and American Colonization Society; the editors of Silliman's Journal of Arts and Sciences at New Haven; Beriah Botfield, of Cambridge, England; and Dr. Dorr, of Philadelphia.

The committee on Dr. Hayden's paper reported in favor of its publication in the Transactions. On motion of Dr. Bache it was so ordered.

Dr. Coates, in behalf of the committee on Dr. Tafel's paper, made an informal report, and the committee was continued.

Dr. Bache exhibited and described a spectroscope which he had just received from London.

The minutes of the last meeting of the Board of Officers and Council were read.

Pending nominations Nos. 423, 424 were read.

On motion of Dr. Bache the recommendation of the committee in regard to completing the printing of the Catalogue was adopted.

And the Society was adjourned.

Stated Meeting, September 20, 1861.

Present, seven members.

Professor CRESSON, Vice-President, in the Chair.

Letters acknowledging publications were received from the Essex Institute, Salem, Mass., dated Aug. 16; the Lyceum

of Natural History, New York, dated Sept. 16; the trustees of the New York State Library, dated Aug. 24; the Historical Society at Chicago, dated Aug. 30, 1861.

A letter announcing the transmission of publications was received from the Royal Academy of Madrid, dated July 15.

A letter requesting correspondence and exchanges was received from Mr. T. A. Cheney, librarian of the Georgie Library, at Leon, Cattaraugus County, New York, dated Sept. 10, 1861.

Donations for the Library were received from Prof. Paolo Volpicelli, of Rome; from the Royal Observatory at Cadiz; from the Royal Asiatic, the Chemical, and the Royal Geographical Societies, in London; from the Boston Society of Natural History; from the Entomological Society and Franklin Institute, of Philadelphia; from the editors of the Astronomical Journal, American Journal, and Medical News and Library; from Mr. Lorin Blodget, Mr. George Ord, and Dr. J. Aitkin Meigs, of Philadelphia.

The committee on Prof. Tafel's paper reported progress, through the chairman, Dr. Coates.

Mr. Lesley described the structure of a primary limestone bed on the Brandywine above Chad's ford, in illustration of the tongue-structure of folded anticlinals.

This exhibition of crystalline limestone is made at and above water-level in a quarry, worked to the depth of between one and two hundred feet, in from the original face of the cliff, and terminated by vertical walls of thirty or forty feet in height. In the floor of the quarry, at water-level, are seen two rude walls of quartzite left standing. These are *apparently* horses of quartz rock in the mass of the limestone. In the walls of the quarry are seen similar lens-shaped masses of quartz fringed in some cases with mica slate. A grand semicylindrical mass of quartz forms part of the wall-heading; and another plate of quartz rock overhangs the edge of limestone seen on the right at the floor level. Judging by the general irregularity of the exposure, taken in connection with the few outcrops of serpentine and marble, in the midst of generally steep or vertically dipping strata of primary slates and sandstones, in this region (south of the Chester County Valley), one might carelessly pass by this exposure as if it were merely, what it is apparently, some crushed layers

of primary or crystalline limestone mixed up with seams of quartzite and mica slate. But when carefully examined it turns out to be an exposure of the summit of a sharp anticlinal axis, of that order which is so common in much-disturbed regions of all ages, and especially worthy of study in the narrow basins of the coal. A diagram (*a*) will show this structure better than any description. The masses of quartzite and mica slate in the walls of the quarry are inverted tongues of the roof-rock, and the apparent horsebacks in the floor are the points of corresponding tongues of the floor-rock.

(*a*)

The occurrence of such cases of fork-tongued anticlinal structure in so obscure a region as that of the Trenton-Philadelphia-Baltimore primary rocks, is important in the present state of our knowledge of this difficult region. No good field analysis of its structure has yet been made. The Final Report of the Geological Survey of the State gives no satisfactory account of it, enters into no details, and acknowledges that the colored limits of the formations upon the map were traced in great measure by conjecture. The mere appearance or outcrop of a primary limestone bed anywhere in this region would be a happy accident, and should be used as a clue to the structure in the way Sir William Logan has used the outcrops of limestone in Canada for working out the structure of the Laurentian formations.

But *the rise and fall in anticlinal* of a limestone bed among these altered sandstones and magnesian slates is much more important and suggestive, both in reference to the general interpretation of the dips of the region and in reference to the sub- or super-position of the Chester County limestone, which to appearance passes underneath the southern hills in the direction of this fork-tongued anticlinal of limestone,—but which most of the Pennsylvania geologists have regarded as a Lower Silurian synclinal with its southern slope overthrown so as to make a south dip where a north dip ought to be.

In itself the shape of this anticlinal is curious enough and strictly analogous not only to those in the coal, a specimen of which is given in figure (*b*), but also to innumerable cases in the gneiss around Philadelphia. Just after entering Fairmount Park and ascending the river road to what was once Pratt's mansion, the horizontal streaks of quartz in the gneiss are seen to form a series of closed zigzags of the same kind. A far more extensive and extraordinary system of these plait-

(*b*)

ings of quartz veins in primary schists and in vertical posture may be studied in the first rock-cutting north of Old York Station on the North Pennsylvania Railroad, about eight miles out of town. In this latter case the quartz seams are perfect for so great a length, and the curves are so sharp, unbroken, close, and numerous, that one is tempted to give up further search for evidence against the possibility of any kind of igneous origin for them; while it is equally evident that the curvature was effected after infiltration, but before the present rock-crystal condition of the seams had been assumed; that is, while the quartz had as yet a quasi gelatinous consistency. Some of these seams of an inch in thickness, now packed up in a space three yards high by one yard broad, would if stretched out straight measure ten or twenty yards in length.

Pending nominations Nos. 423, 424 were read.

And the Society was adjourned.

Stated Meeting, October 4, 1861.

Present, six members.

Dr. FRANKLIN BACHE in the Chair.

Letters were received from the corporation of Yale College, dated Sept. 1861; the Boston Public Library, dated Oct. 1, 1861; and from Mr. J. W. Nystrom, in relation to a new system of arithmetic, weights, measures, and coins.

Donations for the Library were received from the London Zoological Society, the Boston Public Library, the Medical News, Prof. Cresson, and the Chevalier Bonghi of Naples.

The MS. of Mr. Nystrom was referred to a committee, consisting of Mr. Dubois, Prof. Kendall, and Prof. Cresson.

Pending nominations 423, 424 were read.

The resignation of Dr. J. J. Reese was accepted.

And the Society was adjourned.

Stated Meeting, October 18, 1861.

Present, ten members.

Professor CRESSON, Vice-President, in the Chair.

Letters acknowledging the receipt of publications were received from the Massachusetts Historical Society, and from the Boston Public Library.

Donations for the Library were received from the Bureau des Ponts et Chaussées; the Dublin Geological Society; the Boston Society of Natural History; the Franklin Institute; and the Office of the Adjutant-General of the United States.

The committee to which was referred the paper of Dr. Herman Leonard Tafel, reported in favor of publication in the Proceedings. On motion the recommendation of the committee was adopted.

Dr. Leidy presented a paper for publication in the Transactions, entitled "Experiments and Observations upon the Circulation in the Snapping Turtle, *Chelonia serpentina*, with especial reference to the pressure of the blood in the arteries and veins," by S. Weir Mitchell, M.D., lecturer on Physiology. Dr. Leidy, Dr. Dunglison, and Dr. Le Conte, were appointed a committee to whom the paper was referred.

Judge Carleton made some remarks upon Necessity and the freedom of the will.

Prof. Kendall and Prof. Cresson made some remarks upon the Tonal system of Mr. Nystrom, and Dr. Bache called the attention of the members present to a pamphlet on the Octonal system, by Mr. Alfred B. Taylor, of Philadelphia, a copy of which Prof. Kendall presented for the Library.

The Society proceeded to ballot for the pending nominations.

New nominations Nos. 425 and 426 were read.

The ballot boxes being examined by the presiding officer, the following named gentleman was declared duly elected a member of the Society:

PAOLO VOLPICELLI, of Rome.

And the Society was adjourned.

INVESTIGATIONS INTO THE LAWS OF ENGLISH ORTHOGRAPHY AND PRONUNCIATION.

By PROF. R. L. TAFEL, A.M.,
Washington University, St. Louis, Mo.

The Elementary Sounds of Language in General, and of the English Language in Particular.

INTRODUCTION.

§ 1. A STRICTLY phonetic mode of writing prevailed originally in those languages which produced their own alphabets, as in the Sanscrit, Arabic, Phœnician, &c. When these alphabets were afterwards adopted by other languages, either some of the superfluous signs were dropped, or deficiencies were made up by the introduction of new signs, as in the Greek, Latin, and also in the Russian of the present day, so that these languages too may be regarded as phonetic. The same may be observed with regard to the Italian, Spanish, German, and most other languages. In the French, and still more in the English language, the case is different, for not only are some of the consonants silent under certain conditions, but in the English language, likewise, the vowels and diphthongs, or rather digraphs, have three or four different modes of pronunciation. Still, even in these languages, the consonants which are now mute, were formerly pronounced, and each of the vowels and diphthongs expressed but one sound. That such was the case in the Anglo-Saxon language we may infer from the fact that the present Germanic tribes, who originally spoke the same language with the Anglo-Saxons, still retain this custom, and their written language, even at the present day, is a reflex of their spoken language. In England the vowels and diphthongs became diversified when the Anglo-Saxon language was wedded to the French. Of this process I shall treat more extensively hereafter. This process was brought about in the popular pronunciation, according to some fixed laws, based on the relationship among the vowels themselves, and their affinity to some of the consonants. This I shall endeavor to prove in a future part of my work.

From this general statement of the changes which took place in the English language, it is evident that before we can discuss the

pronunciation of the English language at all, we require a minute insight into the formation of the vowels and consonants, and into their mutual relations. In support of my own theories I shall mainly adduce the work of Dr. E. Brücke of Vienna, member of the Imperial Academy of Sciences, on the principles of phonology, which was first printed in the Journal of the Austrian Colleges for 1856, and afterwards published separately, with the addition of a valuable plate, exhibiting the various positions of the tongue, and of the mouth in general, in the pronunciation of some of the vowels and consonants. The researches of Dr. Brücke are carried on in the most systematic and thorough manner, and the style in which he treats his subject betokens at once the finished scholar and the man of clear understanding. Moreover, as he gives us in a nutshell, as it were, all that has previously been done in this department, I regard him as the first authority in all matters connected with the physiology of language.

Dr. Brücke opens his subject in the following manner: "In investigating the sounds of language we can proceed in a twofold way. We can examine the manner in which cognate sounds become affected by each other, and by tracing the changes which the various sounds undergo, in the course of time, and in passing from one language into another, we are enabled to draw conclusions as to their nature and their several attributes. Such is the mode of the linguist. On the other hand, we can institute direct observations and experiments, with a view of ascertaining the way in which and the conditions under which they are produced by the organs of speech; and in this manner, also, we can acquire knowledge concerning their respective nature and properties. Such is the mode of the physiologist. Neither method, when properly applied, can ever lead to contradictory results, but they may produce different results which are mutually supplementary to each other; thus the linguist in the course of his examinations may evolve a series of laws which are to be explained on physiological grounds. Unless the linguist take a physiological view, he can never have a full idea of language; for, in case he neglects this, he only knows that much concerning language which is heard by the ears and written with the hands; he knows as little about the wonderful mechanism which gives birth to language, as about the hidden wheel-work directing the motions of an automaton. Those laws which were formerly derived from euphony, are not so much owing to this cause as to the mechanical arrangement of the organs producing the sounds of language, which can only produce them with volubility and precision in certain combinations. It is

certainly true that the linguists have always evinced an interest in that part of science which treats of the formation of sounds, but up to the present day it cannot be said that they have heartily embraced the facts revealed to them by physiology; else they could not have advanced such systems of sounds, in which not only the original relationship existing between these sounds is disregarded, but even the simple and the compound consonants are not strictly separated."

In these remarks I perfectly agree with Dr. Brücke, and I am firmly persuaded, that all laws regarding the interchange of vowels and consonants, and thus also the laws of English pronunciation, can only be explained on a physiological basis.

§ 2. Of the history of phonology or the science of elementary sounds Dr. Brücke gives us the following sketch:

"To judge from the systematizing and the development of the written characters among the Hindoos, the physiological part of phonology seems to have reached among them, at an early time, a high degree of perfection; indeed, much more so than among the Greeks. At a later period the Arabians made a frequent and close study of the sounds of language, while in Europe, during the middle ages, phonology was not cultivated at all. However, it is only in modern times that the results of a physiological study of the sounds of language were applied to life and tested by practice. For there was still an immense difference between writing many things on the formation of the sounds in language, and being so far acquainted with their essential nature as to be able to instruct beings deprived of the sense of hearing in language by their sense of sight and feeling, and thus to make them participants of the blessing of language."

"Pietro Ponce, a Spanish Benedictine monk, who must be regarded as the founder of the science of phonology, and the benefactor of thousands of men, yea, their deliverer from a state of idiocy like that of the brutes, was the inventor of the instruction of the deaf and dumb. He died at Oña A. D. 1584. . . . . His success, both as regards the intellectual development of his pupils and their facility in speaking, seems to have been very remarkable, according to the trustworthy testimony of contemporaries. He is said to have written a book on this subject, which has been lost."

"The oldest work extant on the instruction of the deaf and dumb is written by Juan Pablo Bonet, '*Reduction de las letras y arte para enseñar á hablar los mutos: Madrid*, 1620;' of which extremely rare work there is a copy both in the Imperial and the University libraries in Vienna. Its author was a secretary of the constable of

Castile, whose brother had lost his sense of hearing, when he was two years old, and hence was deaf and dumb. This circumstance induced him to prosecute those studies, the fruits of which he bequeathed to us in his work." . . . .

"Independently of the discoveries of the Spaniards, physiological phonology and its practical application to the instruction of the deaf and dumb was established by the celebrated *John Wallis*,* who prefixed to his English grammar, first printed in 1653, a '*Tractatus grammatico-physicus de loquela*,' and in the years 1660 and 1661 instructed two deaf and dumb pupils. His success was no less remarkable than that of Ponce, and in a letter to *Amman*, a Swiss living in Holland, who about thirty years later discovered independently the mode of instructing the deaf and dumb, he states that he proceeded so far as to enable one of his pupils to pronounce the most difficult Polish words, enunciated for him by a Polish nobleman, so that the latter was astonished at his proficiency. As Wallis was a very learned man, in elaborating his system of phonology he was enabled not only to take into consideration the English, but also the Latin, Greek, Hebrew, Arabic, Persian, German, French, Cymric, and Gaelic languages." . . . .

"The greatest progress in phonology was made towards the close of the eighteenth century in Germany, at Vienna, where *Wolfgang von Kempelen*, in constructing his speaking-machine, was not only led to investigate the manner in which man produces the sounds of language, but also to examine the conditions under which they can be pronounced at all. In these endeavors he was more successful with regard to the consonants than the vowels, of which Robert Willis (1828) first gave us a satisfactory account. *However, the formation of the vowels still presents to us considerable theoretical difficulties, which it will take a long time perhaps to solve in a satisfactory manner.* With respect to all the rest we may say that Kempelen has left us a system of physiological phonology, which was improved and completed, it is true, in after-times, but which was so firmly established by him, that it furnishes the surest foundation for all subsequent investigations."

* Dr. Brücke calls him erroneously a "bishop." He was no bishop, but professor of geometry at Oxford, and afterwards one of the royal chaplains; he was also one of the earliest members of the Royal Society. Dr. Brücke evidently confounds him with Bishop John Wilkins, who lived at the same time, and rendered himself famous by his "Essay towards a real Character and Philosophical Language."

In his own researches, *Dr. Brücke* bases himself on the works of *Kempelen* and *Willis*, and at the close of his work, gives a synopsis of the systems of *J. Wallis* (Gram. Linguæ Anglicæ, Oxon. 1653), *Court de Gebelin* (Monde primitif, &c., Paris, 1757), *Kempelen* (Mechanismus der menschlichen Sprache, Wien, 1791), *du Bois-Reymond* ("Cadmus oder allgemeine Alphabetik," in a journal called "die Musen," 1812), *Chladni* (Gilbert's Annalen, 1824), *Purkine* (Badania w przedmiocie fiziologii mowy ludzkiej, 1836), *Dr. Joh. Müller* (Lehrbuch der Physiologie, 1844), *Ellis* (Essentials of Phonetics), *Lepsius* (Das allgemeine linguistische Alphabet, Berlin, 1855), *Max Müller* (Languages of the Seat of War, London, 1855). In addition to these works, I have consulted *Olivier* (Urstoffe der menschlichen Sprache, Wien), *Bindseil* (Abhandlungen zur Allgemeinen Vergleichenden Sprachlehre, Hamburg, 1838. This work is a general repository of everything almost that has been published on the subject of phonology), *K. Heyse* (System der Sprachlaute in Höfer's "Zeitschrift für die Wissenschaft der Sprache," Vol. IV 1, 1853, and also in his "System d. Sprachwissenschaft," edited by Steinthal, 1856), *Falkmann* (Declamatorik, Hannover, 1836), *Rapp* (Physiologie d. Sprache, Stuttgart, 1836), *Dr. Bruch* (Zur Physiologie d. Sprache, Basel, 1854), *Dr. Rush* (Treatise on the Human Voice, Philadelphia), *Sir John Herschel* (Treatise on Sound, in "Encyclopædia Metropolitana"), and also the introductions prefixed to the dictionaries of *Walker*, *Smart*, *Webster*, *Worcester*, and *Flügel*. A great deal of information has been derived from the excellent articles of *R. von Raumer* on phonology, orthography, and permutation of the consonants, in the Journal of the Austrian Colleges, where among other works he has also reviewed the essay of Dr. Brücke. It is quite interesting to watch the encounter between these two gentlemen, of whom the former represents the linguists, desiring to acquire a physiological basis for their science, and the latter the physiological observer, unembarrassed by any linguistic system. In addition to his linguistic opponent, Dr. Brücke had to cope with adversaries in his own camp, as with Professor Kudelka, Dr. Merkel, &c.

As regards my own mode of proceeding in this matter, I became early imbued with the idea that the problem of English pronunciation and orthography can only be solved on physiological grounds, and thus, studying the interchanges of the vowels and consonants in the English and other languages on the one hand, and experimenting on the physiological formation of the vowels and consonants on the

other, I developed a system of my own, both of the vowels and consonants, and by means of it endeavored to explain the subject of English pronunciation. This system was elaborated by myself without the assistance of any work on phonology, but on comparing it with the results of others, and especially with those of Dr. Brücke, I was glad to find that it coincided with the latter in all important particulars. In the following dissertation I shall retain my own phraseology and diagrams, which I do not find it necessary to alter, on comparing them with the results of others. Wherever my own views differ materially from the above authorities, or whenever I advance any new statements, and also when I wish to substantiate my own theories by the experiments of others, in accompanying remarks, I shall enter more fully into the subject.

CHAPTER I.

ON ARTICULATE SOUNDS IN GENERAL.

§ 3. In language we distinguish three classes of *articulate sounds*, viz., the vowels, semi-vowels, and consonants.

1. The *vowels* have this particular quality, that they can be sounded loudly and continuously, and that in the formation of words they may possibly do without consonants, as in *I*, *a*, *aye*, &c., but the consonants never without the vowels. The vowels are emphatically the souls of words, while the consonants and semi-vowels are their bodies or skeletons.

2. The *semi-vowels*, viz., *r*, *l*, *m*, *n*, partake of the nature both of the vowels and of the consonants; like the vowels they can be sounded loudly and continuously, but like the consonants they ordinarily do not form any words without the enlivening presence of the vowels. In some languages they are even used in the place of vowels, as in the Slavonic languages and the Sanscrit, or they represent entire syllables, as in the English language (see at the close of Chapter VIII).

3. The *consonants* are mute, and can scarcely be heard, unless they are either preceded or followed by vowels; some consonants can be prolonged like the vowels and semi-vowels, but they are not sonorous, as *f* and *s*; and in case they are sonorous, as *th* in *thee*, *v* and *z*, there are still other reasons excluding them from the semi-vowels (see § 11).

In addition to these three species of articulate sounds, there are some sounds, viz., *w* and *y*, which may be called *vowel-consonants*. They form a sort of connecting link between the vowels and consonants, as we shall see hereafter, § 7.

[Rem. 1.—Concerning the application of the term *articulate sound* to the vowel, Professor Fowler says in his English Grammar, page 99, "A consonant is, in the strict sense, an articulation, or an articulate sound. But in use, the term is extended to vowel-sounds."]

[Rem. 2.—The articulate sounds are usually divided by all linguists and physiologists into two classes, viz., vowels and consonants, and while the physiologists in general, including Dr. Brücke, make no separate class at all of the sounds, *r*, *l*, *m*, and *n*, but class them among the rest of the consonants, the linguists usually divide the consonants into mutes and liquids; and the liquids are sometimes called semi-vowels, as by Sextus Empiricus, and also in the Sanscrit, where, moreover, the vowel-consonants are included under this term. My reason for making a separate class of the semi-vowels is, that, although they agree in some important particulars with the consonants, the history of language still shows that in the body of words they display a very different power from the latter, making it advisable to separate them entirely from them.]

CHAPTER II.

ON VOWELS AND VOWEL-CONSONANTS.

§ 4. In the formation of the vowels, the air, coming from the lungs, is first rendered sonorous by striking against the contracted inferior ligaments of the glottis; it is afterwards modulated, in passing out by the mouth, by changes wrought in the shape of the pharynx and of the cavity of the mouth; these modulations are what are called *vowels*.

The changes wrought in the pharynx are of too interior a nature to be distinctly noticed, but those which take place in the cavity of the mouth can be very readily examined. They consist 1, in a greater or lesser elevation of the middle portion of the tongue, either in the anterior or posterior part of the mouth, and 2, in the enlargement, and greater or lesser contraction of the mouth.

When the tongue is in its natural position, with none of its parts

raised, and when the opening of the mouth is at the same time enlarged, we obtain the sound of *a* in *father*. Upon raising the middle of the tongue, in the anterior part of the mouth, about midway, and, at the same time, keeping the opening of the mouth enlarged, we find that there is a transition from the sound of *a* in *father* to that of *e* in *edge* or *a* in *age*. If, then, we continue to raise the middle of the tongue, until we reach the roof of the mouth, still keeping the opening of the mouth enlarged, we obtain the sound of *i* in *machine*. If, in pronouncing the sound of *i* in *machine*, we contract the opening of the mouth to the utmost of its capacity and, at the same time, thrust the lips forward, then gradually draw the middle of the tongue into the posterior part of the mouth, suffering it there to touch the soft palate, it will be found that there is a transition from the sound of *i* in *machine* into that of *u* in *flute*. If, then, we there lower the raised part of the tongue about midway, and, at the same time, relax somewhat the contraction of the opening of the mouth, we arrive at the sound of *o* in *note;* and if we lower the tongue altogether, and gradually enlarge the opening of the mouth, we again arrive at the sound of *a* in *father* from which we started.

[Rem.—This whole process may be verified by the reader, upon inspecting his organs of speech, during the pronunciation of these several vowels, with the help of a looking-glass. In order to be able to do this, he must, however, train himself to pronounce the sounds of *u* in *flute* and of *o* in *note* with the mouth wide open. There is no difficulty in doing this, inasmuch as a contraction of the opening of the mouth, although it is of great assistance in the pronunciation of these sounds, is by no means necessary for their production. Upon inspecting the position of the tongue in the pronunciation of *a* in *father*, the reader will observe that the tongue is as it were drawn back into the mouth, so as to leave the space behind the lower teeth exposed; the use of this drawing back of the tongue is partly to produce in the pharynx the necessary shape for the production of this sound, and partly, also, to obtain as much resonance in the cavity of the mouth, as is required for a proper enunciation of this sound. In the pronunciation of *a* in *age* the reader will perceive that the tip of the tongue is pushed forward and raised to the level of the lower teeth, and its middle portion at the same time elevated. With regard to the pronunciation of the sounds of *i* in *machine*, *u* in *flute*, and *o* in *note*, I have nothing more to say, except that the reader will find my statements as to the mode of their production verified. In case he should, however, experience any difficulty in pronouncing

the two latter sounds with the mouth wide open, in order to convince himself of the fact that in the pronunciation of *o* in *note*, the middle of the tongue is raised about midway in the posterior part of the mouth, let him put one of his fingers lengthwise into the mouth, and pronounce successively the vowels *a* in *father*, and *o* in *hole*, and he will find that in the pronunciation of *a* in *father* the tongue remains entirely undisturbed, but in the pronunciation of *o* the middle of the tongue is raised and presses against the finger, which pressure increases upon the pronunciation of *u* in *flute*.]

From this description it is evident that the changes in the cavity of the mouth which contribute to the modulation of the vowels, consist in an elevation and depression of the middle of the tongue in the anterior and posterior parts of the mouth; it is evident, also, that the true order of succession of the vowels is *a*, *e*, *i*, *u*, *o*, *a*, &c. in *fAther*, *Edge*, *machIne*, *flUte*, and *nOte*, and that there is a natural transition from each of these vowels into the next.

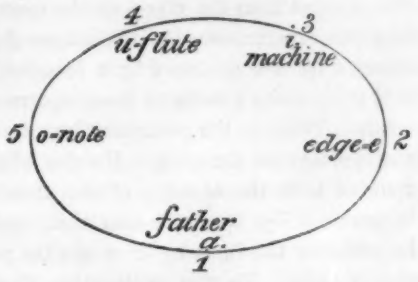
With regard to the process by which the several vowel-sounds are formed, I must further observe, that, although the position of the middle of the tongue, and the enlargement and contraction of the opening of the mouth are essential to a full pronunciation of each of these vowels, they are by no means the only part of the mouth influencing their modulation. Each change in the position of the middle of the tongue, and in the enlargement and contraction of the opening of the mouth, is the effect of a certain disposition of those organs of speech which effect an alteration in the shape of the cavity of the pharynx, viz., the larynx, the root of the tongue with the *os linguæ*, the muscular portion of the pharynx itself, and the soft palate with the uvula, which opens and shuts the passage to the nostrils. The changes in these parts of the mouth are beyond our scrutiny, as well as beyond our control. All we can know about their disposition is, that during the pronunciation of *a* in *age* and *i* in *machine*, where the tongue is drawn into the anterior part of the mouth, and presses more or less against the palate, the space in the pharynx must be greatest, whilst in the pronunciation of *u* in *flute*, and *o* in *note*, where the tongue is drawn into the posterior part of the mouth, it must be smallest (read also the experiments of Dr. Czermack with regard to the greater or lesser tension of the soft palate in the pronunciation of the several vowels, in Remark 2); however, of the peculiar deflections and the shape of the pharynx during the pronunciation of each of the vowels, we have as yet no definite particulars. There is one circumstance showing us clearly the effect of the in-

ternal parts of speech on the modulation of the vowels; for, upon making the attempt, we find that an arrangement merely of the outer parts of the mouth, without a corresponding disposition of its inner parts, is not sufficient for the modulation of the vowels. For instance: let the outer parts of the mouth be kept in the position which they occupy in the pronunciation of *i* in *machine*, and let the interior parts of the mouth be disposed for the pronunciation of the vowel *a* in *father*, *i. e*, let the reader try to pronounce the sound of *a* in *father*, with the tongue in the position which it occupies in the pronunciation of *i* in *machine*, and he will find, after some trials, that he may succeed in pronouncing the sound of *a* in *father*, or at least an approximation to it, under these circumstances. It does not, however, follow from this that the conclusions at which we arrive, by carefully noting the changes in the position of the middle portion of the tongue, and in the enlargement and contraction of the opening of the mouth, are based upon fallacious grounds; for I hold, as I have stated above, that the changes in the arrangement of the outer parts of the mouth are effects, corresponding to changes wrought in the disposition of its inner parts; and were we enabled to analyze the changes in the latter as well as in the former parts, we might thence deduce results similar to those at which we arrive by considering the positions of the mere outer parts. I shall, therefore, in speaking of the formation of the several vowels, continue to treat the position of the middle portion of the tongue, and the enlargement and contraction of the opening of the mouth as prime factors, but I wish distinctly to be understood, that, in saying that a certain position of the tongue, together with a proportionate enlargement or contraction of the opening of the mouth, determines the particular sound of a vowel, I, at the same time, suppose a corresponding arrangement of the interior parts of the mouth, or, in other words, I suppose a disposition on their part to pronounce those vowel-sounds for the pronunciation of which the outer parts of the mouth have been arranged.

Upon analyzing the positions of the tongue in the formation of the above vowel-sounds, we find that they describe a curve, resembling a circle or an ellipse. The point 1, denotes the place where the tongue is at rest; point 2, where the middle of the tongue is raised half-way in the anterior part of the mouth; point 3, where the middle of the tongue reaches the anterior part of the palate; point 4, where it reaches its posterior part; point 5, where it is lowered in the posterior part of the mouth about midway; and point 1,

where it is again at rest. The vowels which are formed in points 1, 2, and 3, are pronounced with the opening of the mouth enlarged; those which are formed in the points 4 and 5 with the opening of the mouth contracted.

Let this series of vowel-sounds be pronounced in the order here indicated, and let the regions of the mouth be noticed into which the several vowels are conveyed by the action of the tongue during their modulation, and it will be found that the position of each in the diagram is correct. Let the reader afterwards repeat this series several times in one breath, and he will not fail to notice how much the pronunciation of the series is like describing a circle or oval in the cavity of the mouth by means of the tongue. Moreover, the vowel-line does not necessarily run from point 1 to points 2, 3, 4, and 5, but it may also run from point 1 to points 5, 4, 3, and 2, and thence back to point 1.



We, hence, see that the above vowel-sounds describe a circle or an ellipse, running either from right to left, or from left to right.

[Rem. 1. In comparing the positions which I have assigned to each of these vowels, with those laid down by Dr. Brücke in the plate, at the end of his volume, the reader will find that they agree perfectly. Dr. Brücke has only sketched the three vowels *a* in *father*, *i* in *machine*, and *u* in *flute*; the vowels *e* in *edge* or *a* in *age*, and *o* in *note*, he regards as intermediate sounds between the former.

Willis produced the vowel *a* in *father* by letting the cog of a cog-wheel strike against a watch-spring of a certain length. By shortening the spring, this sound passed over into that of *a* in *age*, and *i* in *machine*, and by lengthening it into that of *o* and *u*. The same result he obtained by shortening and lengthening a pipe, in which a sound was produced by the vibration of a tongue. Dr. Brücke repeated these experiments. He could not produce any vowel-sounds from the watch-spring, but he succeeded in obtaining them from the pipe. Compared with the vowels of the human voice, he says they were very indistinct; but still he thinks that Willis lighted upon a very important point in the matter. He, moreover, says that a varia-

tion of the sounds is produced by enlarging and contracting the orifice of the pipe. Kempelen produced his vowels by applying an India-rubber funnel to his vocal apparatus and closing its aperture more or less with his hand. Dr. Brücke repeated this experiment also, and found that the vowels thus obtained, were no worse than those elicited from the pipe; on the contrary, a little better. From these two experiments, Dr. Brücke concludes that the vowels of the human voice are produced by a lengthening and shortening of the vocal tube, and a greater or lesser contraction of the opening of the mouth. Thus, in the pronunciation of *u* in *flute*, he says the vocal tube is elongated the most. He also admits that this sound may be produced with the opening of the mouth enlarged, but not unless the jaws and lips approach somewhat, analogous to the contraction of the orifice of the funnel. In a similar manner he accounts for the other vowels. To this explanation Prof. Kudelka (Ueber Herrn Dr. Brücke's Lautsystem, Wien, 1858, page 18) objects that Dr. Brücke makes no account of the experiment of Kratzenstein (Petersburg, 1781), who produced the vowels in an artificial manner by fixing sundry pipes of an odd shape to a vocal apparatus; and in making an application of this third experiment to the human organs of speech, he says that in the pronunciation of the vowels the vocal tube is not only lengthened and shortened, and its orifice expanded and contracted, but also its very shape altered by the various positions of the tongue. In this he is correct, but he does not inform us what particular shapes the tongue assumes. He even thinks it unnecessary, as, according to his wise remark, everybody knows by practice how to place his tongue, in order to pronounce the several vowels.— With regard to the formation of the vowels, it is my opinion that by the contraction and various disposition of the parts forming the pharynx, different angles are produced, by which the voice is deflected as it proceeds from the glottis. By this deflection the rudiment of some one of the vowels is impressed upon the sonorous breath, which is afterwards developed into a full vowel by the corresponding shape of the cavity of the mouth, as it passes out by the mouth.

With regard to the arrangement of the internal parts of the mouth, Dr. Brücke states (page 20) that *Purkine* first rightly observed that in passing over from *a* in *father* to *a* in *age* the pharynx, *i. e.* the space between the larynx, the muscular portion of the pharynx itself, the soft palate, and the root of the tongue, is enlarged and remains so during the pronunciation of *i* in *machine*. This enlargement of the pharynx he explains as a necessary consequence of the muscular

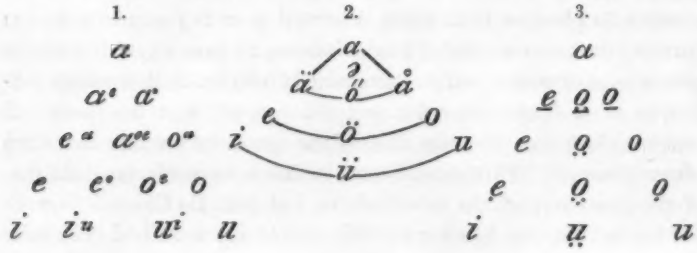
force by which the middle portion of the tongue is raised towards the palate in the pronunciation of these vowels, and the *os linguæ* and the larynx are elevated. In the pronunciation of *u* in *flute*, on the other hand, he says, the space of the pharynx is most limited, because the *os linguæ* and the larynx are most depressed. On this same subject *A. De Chevallet* (Origine et Formation de la Langue Française, Seconde Partie, Paris, 1857), page 47, makes the following remarks: "Les différentes modifications de la voix, appelées *voyelles*, sont dues au reserrement plus ou moins considérable des parois du gosier ou pharynx, au moment de l'émission de l'air sonore, ainsi que l'a fort bien établi M. Léon Vaïsse.* Cette contraction des muscles du pharynx suffit seule, il est vrai, pour la production du son voyelle; mais ce son, confus à sa naissance, ne peut acquérir toute sa précision et sa netteté qu'en traversant la bouche, dont certaines parties, en vertu d'une connexion sympathique, affectent des poses, qui correspondent aux diverses dimensions que peut prendre la cavité pharyngienne." This gives, almost in the same words, my definition of the generation of the vowels above, but Mr. De Chevallet's work did not fall into my hands until this part of my work had been fully elaborated. (See also the report of Dr. Czermack's experiments concerning the tension of the soft palate in Rem. 2.) From these statements it is rendered very evident that in the pronunciation of the various vowels different angles are produced in the pharynx, modulating and deflecting the vocal breath. The same theory that the modulation of the vowels is effected in the pharynx is also held by Olivier in his "Urstoffe, &c.," page 86.

However, the formation of the vowels itself is not of so much importance in our future investigation—it is the true order of the succession of the vowels which interests us most; and there it will be found that the experiments of Willis and Kempelen completely confirm my own theory; for they prove that from *i* in *machine* there is a transition into *a* in *age*, and thence into *a* in *father*, *o* in *note*, and *u* in *flute*, and also from *u* in *flute* into *o* in *note*, *a* in *father*, &c. Between each of these vowels Dr. Brücke assumes an indefinite number of intermediate sounds, establishing their connection, and the same thing he does between *i* in *machine* and *u* in *flute*, and thus acknowledges their connection. He thus substantiates every one of the opinions which I have advanced above. I must observe here

* *De la parole considérée au double point de vue de la physiologie et de la grammaire*, par Léon Vaïsse, 1853, broch. in 8°. I endeavored to obtain a copy of this, no doubt, interesting work, but did not succeed.

that Dr. Brücke does not entertain in his work the idea of a vowel-line, such as presented in my work; but, nevertheless, he furnishes all the elements for constructing one.

A favorite diagram among the phonologists for the illustration of the vowels (which is also used by Dr. Brücke) is a triangle, of which *a* in *father* forms the apex and *i* in *machine* and *u* in *flute* the base; of this we give here some specimens: No. 1 is used by Dr. Brücke, page 23, No. 2 by Prof. Rapp (Physiologie d. Sprache, vol. i, page 30), No. 3 by Prof. Lepsius (in Bunsen's Philosophy of Universal History, vol. ii, page 401):



In favor of my own diagram I hold that it represents a line described by the tongue itself in the cavity of the mouth, during the successive pronunciation of *a* in *father*, *a* in *age*, *i* in *machine*, *u* in *flute*, and *o* in *note*. The upper limb of the oval, from point 3 to 4, is the line traversed by the raised middle portion of the tongue, when from the sound of *i* in *machine* by means of intermediate sounds we arrive at the sound of *u* in *rude*. The posterior extremity of the oval from point 4 to point 1, is a line described by the middle portion of the tongue upon sinking down from the raised position it occupies in the pronunciation of *u* in *flute*, through *o* in *note*, into that of *a* in *father*. The lower limb of the oval with point 1 is produced when the middle portion of the tongue, after having finished its work in the posterior part of the mouth, by a stretching of the whole member is brought into the anterior part of the mouth again, ready to generate anew the vowel-sound *a* in *age*. The anterior extremity of the oval with point 2, finally, is described, when from its depressed position during the pronunciation of *a* in *father*, the middle portion of the tongue is gradually raised again in the anterior part of the mouth, until, after passing through the position of *a* in *age*, it finally reaches that of *i* in *machine*. By this diagram, representing the very motions of the tongue, we are not only enabled to explain the

formation of the vowels and their relationship to one another, but, by its means, we can also describe the minutest shades of these five fundamental vowel forms which are noticed in the various languages, and, finally, we are enabled also to represent by it in a satisfactory manner the genesis of the diphthongs.

[REM. 2.—The experiments of Dr. Czermack concerning the tension of the *velum palati* during the pronunciation of the several vowels, alluded to in the previous article, have been published in the Transactions of the Imperial Academy at Vienna, March 12, 1857, page 6. They consist in Dr. Czermack's introducing through his nose a very ingenious lever, in such a manner that one end of it bent in a certain way and with a little wax around it, rested on the *velum palati*, while the other end extended through the nose, and was fixed in such a manner as to indicate the least motion of the *velum*. By means of this lever Dr. Czermack found that the *velum palati* for each vowel assumes a different position, or at least a different form. Afterwards he had water injected through his nose, with his head bent backward, and in pronouncing *a* in *father* he found that the water was scarcely held back at all by the *velum*, while in pronouncing *i* in *machine* he could easily retain it for some time, and likewise in pronouncing *u* and *o;* but in pronouncing *e* in *edge* the water was again held back with a greater difficulty. These results obtained by the injection of the water tallied exactly with those obtained by the lever. Dr. Czermack's conclusions from his experiments are these: "The *velum palati* has for each vowel not only a definite declination or arcuation, but most probably its tension also is varied, so that its modulus of elasticity becomes changed; thus the shutting of the nasal cavity in some vowels seems to be much more close and firm than in others." This affection of the *velum palati* by the pronunciation of the different vowels, goes very far to prove that in the production of the vowels the sonorous breath becomes modulated or deflected by different angles of the pharyngal cavity.

In addition to these experiments on the *velum palati*, Dr. Czermack has also made some very highly interesting experiments on the production of the human voice in the glottis, by means of Garcia's laryngal speculum. His results, after having first appeared in the Transactions of the Imperial Academy, have afterwards been published separately in a monograph, entitled, "Der Kehlkopfspiegel," &c., to which I refer the reader.]

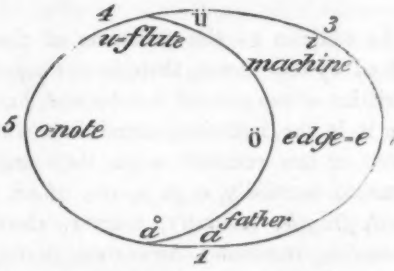
§ 5. The five vowel-sounds specified in the diagram above, viz., *a* in *father*, *e* in *edge*, *i* in *machine*, *u* in *rude*, and *o* in *hole*, are the

five *general vowel-sounds* common to all nations, and no other sounds are designated by these letters in any other except in the English language.

Besides these general vowel-sounds common to all languages, there are also *particular vowel-sounds*, peculiar to individual tongues. They are variations or shades of the general vowel-sounds, produced either by changes in the opening of the mouth, or by slight alterations in the positions occupied by the tongue in the pronunciation of each of the general vowel-sounds. For instance, the vowel-sounds, *a* in *father*, *a* in *age*, and *i* in *machine*, which are naturally pronounced with the opening of the mouth enlarged, may also be pronounced with the same contracted; or, leaving the opening of the mouth undisturbed, the tongue may be slightly raised from the standard position which it occupies in the pronunciation of *a* in *father*, or else it may be slightly lowered from the positions which it occupies in the pronunciation of *a* in *age*, *i* in *machine*, *u* in *flute*, and *o* in *note*; always supposing, however, these changes to be attended with corresponding alterations in the disposition of the internal organs of speech, or rather regarding them as the effects of slight modifications wrought in the arrangement of these internal parts.

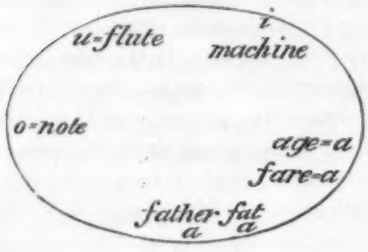
As regards the former method of varying the general vowel-sounds, viz., by a change in the opening of the mouth, it must be observed that no change in the anterior parts of the mouth can possibly affect the pronunciation of the general vowel-sounds, *o* in *note* and *u* in *flute*, because their modulation is effected in the posterior part of the mouth, near the soft palate, independently from any subsequent change in the opening of the mouth; these two vowel-sounds, therefore, although a contraction of the mouth is of great assistance in their pronunciation, can still be distinctly uttered with the opening of the mouth as much enlarged as in the pronunciation of *a* in *father*. In the case of *a* in *age* and *i* in *machine* it is different, for their modulation is effected in the anterior part of the mouth, and any change there necessarily affects their sound. However, even in their case a mere superficial contraction of the opening of the mouth, as in the pronunciation of *o* in *note*, and even of *u* in *flute*, does not vary their sound much, but the very cheeks also require to be contracted in order to produce any decided change. If, then, we pronounce the sound of *a* in *age* with the cheeks contracted, we get the sound of the German letter ö or of the French *eu* and *oeu*, and if we pronounce *i* in *machine* in the same way we obtain the sound of the German ü and of the French *u*. The only difference between the

German and French sounds consists in the latter being pronounced with the tongue a little more depressed than is the case with the German sounds. As regards the relation of these two particular vowel-sounds in respect to the general vowel-sounds, it must be observed that the German ö or French *eu* is an intermediate sound between *o* in *note* and *e* in *edge* or *a* in *age*, and its place is consequently in the middle of our diagram; the German ü or French *u*, on the other hand, is an intermediate sound between *i* in *machine* and *u* in *flute*, and it is consequently a member of the vowel-line. The only variation of the general vowel-sounds obtained by this method which is found in the English language, is the sound of *a* in *all* or *aw* in *law*. In its pronunciation the tongue remains in the position of *a* in *father*, with the lower jaw more depressed, and the cheeks and mouth contracted in the same manner as in the pronunciation of ö and ü. It is an intermediate sound between *a* in *father* and *o* in *note*, and is consequently a member of the vowel-line. This sound is confined to the English and Swedish tongues; in the latter it is represented by the sign *a*°, which I shall adopt in the present work; this sound is also found in some of the southern German dialects, viz., the Suabian, Bavarian, and Austrian. The relations between *a*°, ö, and ü, are the same as between *a* in *father*, *a* in *age*, and *i* in *machine*; they form a sort of inner circle in that described by the five general vowel-sounds, as may be seen in the diagram. They all have this feature in common, that in their pronunciation the cheeks and mouth are contracted; in *a*° the tongue is at rest, though slightly raised towards *o* in *note*, in ö it is raised halfway, and in ü it reaches the roof of the mouth; between each of these sounds also there is an indefinite number of intermediate sounds, establishing a connection between them.



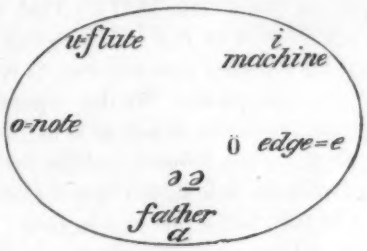
In respect to the second method of varying the general vowel-sounds, viz., by a slight alteration in the position of the tongue, the pronunciation of all the general vowels is affected thereby. However, only variations of the sounds of *a* in *father* and *a* in *age* are in use. It has been noticed above that in the pronunciation of *a* in

father the tongue is as it were drawn back into the mouth, and the space behind the lower teeth exposed; if, now, the tongue is pushed forward, so as to fill up the space behind the lower teeth, and if it is at the same time raised on a level with the lower teeth, the sound of *a* in *fat* is produced. This sound is peculiar to the English language, and in most cases has superseded the sound of *a* in *father*, of which it is a variation. If, on the other hand, we slightly lower the tongue from its position in the pronunciation of *a* in *age*, we obtain the sound of *a* in *fare*. Both these sounds are intermediate sounds between *a* in *father* and *a* in *age*; *a* in *fat* being nearer to *a* in *father*, and *a* in *fare* to *a* in *age*, as appears from the annexed diagram.

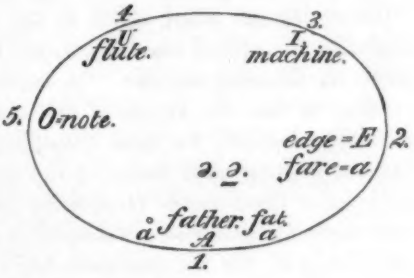


In addition to the variations of the general vowel-sounds, obtained by this means, there is one sound which cannot be called a variation of one general vowel-sound, but rather of all five together; for it is the indistinct sound into which all English vowels are more or less resolved when they are unaccented and are pronounced hurriedly, *e. g.* A*gain*, *alt*A*r*, *cal*EN*d*E*r*, *lawl*E*ss*, *mod*E*st*, *ac*I*d*, *frag*I*le*, *calam*IT*y*, *mart*Y*r*, *clearl*Y, *eb*ON*y*, *vig*O*r*, *parl*OU*r*, *abandon*, *command*, *handsome*, *gen*U*s*, *inj*U*ry*, &c. Upon analyzing the nature of this sound we find that it bears much resemblance to the sound which is produced in heaving a sigh, or in laughing and sobbing, or which, according to Max Müller, page xlv, is heard if we take the larynx of a dead body and blow through it, while compressing the *chordæ vocales*. On this account it is regarded by some linguists and physiologists as the primitive vowel, in the form in which it leaves the glottis, and as the material from which all the other vowels are developed. By emphasizing this sound, as is done in all accented syllables, we obtain the sound of *o* in *love* and *u* in *but*. The sound of *e* in *her*, *i* in *bird*, *u* in *hurt*, is an amalgamation of this sound with the palatal *r*. There is some difficulty in finding an appropriate sign for the representation of the indistinct vowel-sound, and its variation by the palatal *r*. *Ludolf*, *Isenberg*, and others, propose ɛ, Bishop *Wilkins*, *y*, printed in italics,

Lepsius, $\ddot{e}_{\circ}$, *Rapp* and *Schmeller* an inverted e, viz., ə, and in lack of a better sign, I shall adopt the latter in the present work; its variation in *her, bird*, &c., I shall express by the same letter inverted with an additional bar under it, viz., ə̲. As regards the position of the indistinct vowel-sound in my diagram, it is placed in the middle, because it is equally near to all the vowels, but it is put nearer to *a* in *father*, because in its pronunciation the tongue is scarcely raised from the position which it occupies in the pronunciation of *a* in *father*. The fact of its being closely related to ö, which is its nearest neighbor in the diagram, may be deduced from this circumstance, that its amalgamation with the palatal *r* in *bird, her*, &c., is that sound in the English language which approaches nearest to the sound of the French *eu* in *heure*, &c.; moreover Dr. Brücke calls the sound of *o* in *done, son*, and of *u* in *sun* an imperfectly formed ö.



The present diagram contains all the general and particular vowel-sounds which are found in the English language. The general vowel-sounds are marked with capital letters, and the particular vowel-sounds with small letters. From this synopsis, we see that there are in the English language five general and five particular vowel-sounds, viz.:



GENERAL VOWEL-SOUNDS.

a in *father*, *e* in *edge*, *i* in *machine*, *u* in *flute*, *o* in *note*.

PARTICULAR VOWEL-SOUNDS:

a in *all*, *a* in *fat*, *a* in *fare*, *u* in *but*, *e* in *her*.

[Rem. 1. The independent nature of the vowel *a* in *fare* has been distinctly recognized by *Worcester* in his "Critical Dictionary," and

by *Flügel* in his German and English Dictionary. It had also previously been noticed by *Perry* (Pronouncing Dictionary, London, 1805), and *Ellis* (Alphabet of Nature, London, 1845); while others, as *Walker*, *Webster*, *Smart*, &c., have classed it with *a* in *age;* and still others with *a* in *fat*, as *Sproat* (Endeavor towards a Universal Alphabet, Chillicothe, 1857). That there is a difference between the sounds of *a* in *fate* and *fare*, can be very readily seen by pronouncing the word *fate* half-way, as far as *fā*, and then passing over into *fare*, viz., *fā-āre*. By this experiment, the reader will find that in passing from the sound of *a* in *fate* into that of *a* in *fare*, the tongue is slightly lowered, and the sound made broader. In French, this distinction is indicated by a change of accent, *é* having the sound of *a* in *fate*, and *è* that of *a* in *fare*. A similar distinction may be observed between the sounds of *a* in *fare*, and *fat* or *staff*, upon pronouncing *fare* half-way, and concluding the word by passing into *staff*, viz., *fā-aff*. This expedient was adopted by R. von Raumer in tracing the distinction between the long and short vowels, and I apply it here in order to show the various sounds of *a*.]

[Rem. 2.—With regard to the sound of *o* in *love* and *u* in *but*, it is regarded as identical with the primary or indistinct vowel-sound by Max Müller (Survey of Languages, page xlv) and Dr. Rapp (Physiologie der Sprache, Vol. I, page 21).

Concerning this sound, which is also called by some writers the original or unmodified vowel-sound, Dr. Brücke (pages 24 and 117) makes the following remarks: "A careful analysis of languages will convince us that the extent of this sound is more limited than is generally supposed; for, upon attempting to imitate such sounds as frequently appear quite indistinct and unmodified, we find that they are regular vowel-sounds imperfectly formed. In many instances, even where the primitive vowel-sound is said to be produced, it does not exist at all, but the consonants follow each other without the intervention of any vowel . . . . Such is the case with the termination *on*, *en*, in English, *e. g.*, in *mutton*, *written*, &c., where, as the reader will observe, the letter *n* is added to *t* without opening the mouth at all for the emission of a vowel." Although there is some truth in what Dr. Brücke states concerning the extent of the indistinct vowel-sound, still its existence in the English language cannot be denied, especially in unaccented syllables. For, although in solemn speech, when the unaccented syllables are distinctly pronounced, the original sound of the vowels is usually heard in the place of the indistinct vowel-sound, it is still universally used in these syllables in common pronunciation.

Lepsius says, that the indistinct vowel-sound is inherent in the liquids and other sonant letters, and that hence they are occasionally found to compose syllables. In reply to this, Dr. Brücke says that what Prof. Lepsius here calls the indistinct vowel-sound is nothing else but the sound of the liquid itself. However, all that Dr. Brücke proves by this is (as we shall see presently), that the indistinct vowel-sound and the sound of the liquid have the same sound; and thus he admits the existence of this very sound.—I grant that in *mutton*, *beckon*, *reckon*, &c., the letter *o* is dropped entirely, and that the loud sound which is heard after *t* and *ck* is the sound of the liquid or semi-vowel *n;* but in *abandon*, on the other hand, the vowel *o* is not rejected, but simply reduced into the indistinct vowel-sound; for, in pronouncing this word, the breath is sensibly ejected through the lips after *d*, while after *t* in *mutton*, it is ejected through the nose. Now, in *abandon*, the indistinct vowel-sound is heard in the place of *o*, while in *beckon*, *reckon*, &c., the letter *o* is entirely dropped, and the semi-vowel *n* is pronounced immediately after *ck* without any intervening vowel; and yet an unpractised ear does not detect the least difference between the pronunciation of these two words. The identity of the proper sound of the liquids or semi-vowels and the indistinct vowel-sound is so striking that we frequently suppose ourselves pronouncing the latter while we pronounce the former; so in the pronunciation of *centre*, *mitre*, *theatre*, *able*, *trifle*, &c., the general opinion is, that the final *e* is pronounced before *r* and *l*, and in order to do away with this anomaly, Dr. Webster proposed in all these cases to place the final *e* before *r*, and to write *center*, *miter*, &c.; while in reality the final *e* in all these words is mute, and the letter *e*, which people imagine that they hear, is nothing else but the proper sound of the liquids themselves. In French, the semi-vowels *r* and *l* in this connection are pronounced with mute breath, as in *possible*, *centre*, &c.

As regards the position of the indistinct or primitive vowel-sound in the vowel-system, Dr. Brücke objects to Dr. Rapp's placing it in his triangular system between *a* in *father* and ö (see Dr. Rapp's diagram, Rem. 1, § 4); thus placing it much nearer to *a* than to the vowels *i* and *u;* for he says justly, that the primitive vowel-sound is equally removed from all the other vowels. In my diagram it is placed almost in the middle of the vowel-system, but nearest to *a* in *father;* because, in its pronunciation, it seems to be conveyed into the middle of the mouth, and the tongue is but slightly raised from the position it holds in the pronunciation of *a* in *father*. Thus it

may be seen that Dr. Rapp was not so very wrong in placing it between *a* in *father* and *ö*.]

§ 6. Thus far it has been my object to enumerate the different vowel-sounds contained in the English language, to explain their formation, and to define the particular point which each of them occupy in the general vowel-line. Our attention will now be directed to the long and short sounds which are formed in each of these points. Concerning this subject, *R. von Raumer* (Deutsche Rechtschreibung, Wien, 1855, page 60), advances some new ideas, of which I propose to give the following synopsis:

It is usually supposed that the long vowels are simply prolongations of the short ones; so that by prolonging the letter *i* in *flit*, we obtain the sound of *ee* in *fleet;* or by prolonging the sound of *e* in *edge*, we get the sound of *a* in *age*. But this is a mistake; the long and short vowels differ not only in the length of time required for their pronunciation, but also in their intonation. The position of the organs of the mouth is the same, but there is a difference in the quality of the sound produced in the glottis. This can very easily be seen by comparing the sound of the vowels in *flit* and *fleet*, and the difference becomes especially striking when we commence to pronounce the word *flit;* but, after pronouncing half of it, pass over into the word *fleet*. By this experiment we find, that during this process the pronunciation of the vowel is suddenly rendered more emphatic. This difference between the long and short vowels is admitted to some degree by Dr. Brücke, but he explains it by saying that in the pronunciation of the short sounds we are very apt not to articulate them as distinctly as when we dwell upon them a little longer. Still, whatever may be its cause, R. von Raumer proves the fact that we make a positive distinction between the articulation of the long and short vowels. This distinction is very important for us to know in investigating the long and short vowels in use in the English language, lest we might account a mere difference in intonation a difference in sound.

The distinction between long and short vowels is made in each of the general and particular vowel-sounds with the exception of *e* in *her*, *i* in *bird*, &c., and *o* in *love*, or *u* in *but*. The quantity of the former sound can either be made long or short, at the option of the speaker, without altering the word any, but the second sound is always found short. Of some vowel-sounds, as of *a* in *father* and *o* in *note*, there are no corresponding short sounds in the English language, but they exist in all other languages. Of the sounds of *a* in

age and *fare*, also corresponding short sounds are found in other languages, and, especially, in the German; but in English they seem to be both merged in one short sound. Yet an acute ear detects a difference between the short English *e* in *edge*, and the same letter in *fell*. The following table gives a synopsis of all the long and short vowel-sounds in use in the English language:

LONG.	SHORT.	LONG.	SHORT.
1. *father*, . . .	———.	5. *sheep*, . . .	*ship*.
2. *fast*, . .	*fat*.	6. *flute*, . . .	*full*.
3. *age*, } . .	*edge, bed*,	7. *note*, . . .	——
4. *fare*, } . .	*fell, cleft*.	8. *off*, ...	*not*.
		all, ...	*what*.

9. *her, bird, fur, word*, either long or short.
10. *love, but*, always short.

From this table it may be seen that in the English language there are eight long and six short vowel-sounds, and one which is common, *i. e.*, which can be pronounced either long or short. Of the eight long sounds, two have no corresponding short sounds, and of the six short, there is one which has no corresponding long sound. There are, therefore, in the English language, altogether fifteen distinct long and short vowels.

In addition to this, it must be stated that in the English language, more than in any other, quantity is dependent on the accent which is given to a syllable, and on the emphasis which a word receives in the sentence. In the English language, the long and short vowels are distinctly uttered only in those syllables which are accented, while in the unaccented syllables they are rendered more or less indistinct, and in a hurried pronunciation even pass entirely off into the indistinct or unmodified vowel, as we have seen above. Such words again, as, when pronounced by themselves, have a decidedly long sound, become short in quantity, both in poetry and in common conversation, when they hold a subordinate position in the sentence. This feature of making quantity entirely subservient to the stress in the sentence, is peculiar to the English language, and distinguishes it as much from other languages as its system of pronunciation and grammar. Indeed, to my mind, it is only another instance of the spirit of the language conquering its forms.

Besides the regular long and short sounds exhibited in the above table, which are pronounced in the accented syllables, there are consequently as many shades of each of these sounds in the unaccented

syllables, as there are intermediate sounds between them and the original or primitive vowel-sound.

[Rem. 1.—Concerning the long sound of *a* in *fast*, Flügel makes the following remarks in the introduction to his English-German Dictionary:

"This sound is no new discovery but something long known and confirmed by practice. William Mitford in his Essay upon the Harmony of Languages (London, 1774) says: 'No English voice fails to express, no English ear to perceive the difference between the sound of *a* in *passing* and *passive;* no colloquial familiarity or hurry can substitute one sound for the other.'—Fulton and Knight, only, previous to Worcester, mark this sound as not being so short as *a* in *fat*, as Walker and Jameson, nor so broad as the Italian *a* in *far*, as Perry, Stephen Jones, Nares and others describe it. Walker (Principles of English Pronunciation, § 79), indeed, disapproves of every middle sound as tending to render the pronunciation of the language obscure and indefinite, but the best usage decides the question by making it a medium between the almost vulgar *a* in *father*, and the affected *a* in *fat* (although this pronunciation is still often heard in good society, particularly among people of the so-called Old School)." Smart also regards it as an intermediate sound between *a* in *hat* and *a* in *father*.

From this exhibition we see that the majority of the orthoëpists are in favor of regarding this sound as a medium between *a* in *fat* and *a* in *father*, and, indeed, one which is longer than the sound of *a* in *fat*. However, from the manner in which it is usually pronounced in this country, I can see no other distinction between it and *a* in *fat*, than that the former is the corresponding long sound of the latter, pronounced with a different intonation of the voice, which makes it appear as if it differed from it in the quality of the sound. Sproat (Endeavor towards a Universal Alphabet) is of the same opinion. He says: "The difference in length has been mistaken, I believe, by many orthoëpists, as it has been by myself, for a difference in sound. The *a* in *fat*, *pan*, and *carry* is short; in *fast*, *pant*, it is the same sound lengthened. There are a few, however, in this country, and I suppose more in England, who do pronounce *grasp*, *fast*, &c., a shade broader, approaching *a* in *father*." The identity of these two sounds is proved clearly, if we pronounce the former of these words half-way, and then pass over into the latter, viz., *fă-ast*.

Rem. 2.—Concerning the long sound of *o* in *off*, Worcester says, in the Introduction to his Critical Dictionary, § 21: "There is a

class of words ending in *f*, *ft*, *ss*, *st*, and *sh*, in which *o* is marked with the short sound in most pronouncing dictionaries, though some orthoëpists give it the sound of the broad *a*, as in *fall*. Mr. Nares gives the sound of broad *a* to *o* in the following words: *off*, *often*, *offer*, *coffee*, *scoff*, *aloft*, *loft*, *soft*, *cross*, *loss*, *toss*, *cost*, *frost*, *lost*, *tost*, *broth*, *cloth*, *froth*, *cough*, and *trough*. To these others might with equal propriety, be added, as *offspring*, *dross*, *gloss*, *moss*, *moth*, *wroth*. Mr. Smart remarks, 'that before *ss*, *st*, and *th*, the letter *o* is frequently sounded *aw*; as in *moss*, *gloss*, &c., *lost*, *cost*, &c., *broth*, *cloth*, &c. This practice is analogous to the broad utterance which the letter *a* in *fast* is liable to receive before certain consonants; and the same remarks will apply in the present case, as to the one referred to, namely, that though the broad sound is vulgar [?], there is an affectation in a *palpable* effort to avoid it in words where its use seems at one time to have been general. In such cases, a medium between the extremes is the practice of the best speakers.' The sound of *o* is also somewhat prolonged in *gone* and *begone*, and in some words ending in *ng*; as *long*, *prong*, *song*, *strong*, *thong*, *throng*, *wrong*."

From these remarks it may be seen 1, that the existence of the long sound of *o* in *off*, &c., is admitted by the orthoëpists; 2, that they regard it as identical with the sound of *a* in *all*, but think it different from *o* in *not*, just as they think *a* in *fast* different from *a* in *fat*. I hold that these two sounds, viz., *o* in *not*, and in *off*, are the same in quality, but differ in quantity; and in order to convince the reader of this fact, I propose to him our old expedient, viz., to pronounce *nŏt* half-way, and then to conclude the words with *off*, viz., *nŏ-off*. By this means it is rendered evident, that the only difference between *o* in *not*, and in *off*, *moss*, &c., lies in the quantity.]

§ 7. Before passing to another subject, I must direct the attention of the reader to a peculiarity of the vowel-system, viz., that the vowels *i* in *machine* and *u* in *flute*, in the pronunciation of which the middle of the tongue approaches nearest to the palate, are two points by which there is a transition from the vowels into the consonants. This becomes evident when we pronounce them in the whispering language (*vox clandestina*); for, if we whisper them and gradually emphasize their pronunciation, we will find that there is a transition from the sound of *u* in *flute* into that of *f* or a mute *v*, and of the sound of *i* in *machine* into that of a sibilant; while the sounds of *a* in *father*, *o* in *note*, and *a* in *age*, retain their characters as vowels, no matter how much stress may be laid upon their pronuncia-

tion. Hence the origin of the vowel-consonants *w* and *y*, to which I have adverted above. This property of becoming consonants is always developed in these two vowels, when they are immediately followed by another vowel. Hence, in the French words *huit, huître*, &c., the vowel *u* is pronounced like *w*, and when they are pronounced hurriedly like *v*; hence, also, *u* in *qu* is pronounced like *w* in English, and like *v* in German. Another evidence of the close relationship existing between *u* and *v* is furnished by the orthography of our old books, in which *u* and *v* are used indiscriminately; moreover, our *w* is nothing else but an initial *u*. When the vowel *i* in *machine* is followed by another vowel and its consonant nature is thus developed, it is spelled in some languages, in the beginning of words, with *y*, and in others with *j*, but in the middle of words its original spelling of *i* is retained. The sound of the vowel-consonants *w* and *y* or *i* is different from that of any of the sonorous consonants or semi-vowels; inasmuch as the sonorous element animating the latter is identical with the primitive or unmodified vowel-sound, while the former, at least in the English language, are each imbued with the sound of the respective vowel-sounds from which they are generated. Thus the sound of *w* is a labial breathing, imbued with the vowel-sound of *u* in *flute*, and that of the vowel-consonant *y* or *i* a guttural or palatal breathing, tinctured with the vowel-sound of *i* in *machine;* they are thus strictly consonants animated by vowels, or consonants generated from vowels, so that they may be called justly *vowel-consonants*. In most languages, the English excepted, *w* forfeits its claim to a vowel-consonant; for in them it is not animated by the sound of *u* in *flute*, but by the primitive or unmodified vowel, as is the case with all other sonorous consonants and semi-vowels, or else it is found entirely mute. In the case of the vowel-consonant *i* or *y*, we find, that under some conditions it loses its sonorous element even in the English language, and becomes a consonant proper; for, in unaccented syllables, when it is preceded by the consonants *t, c, s*, or *z*, it reduces every one of them into the rough sibilant *sh*, and, losing its sonorous quality, it is either merged itself into this sibilant, as in *nation, partial, patient, special, proficient, gracious, vision, glazier*, &c., or, else, retaining its sound of *i*, it simply assibilates these consonants, as in *associate, satiate*, &c., and also when it precedes the accented syllable, as in *negotiation, pronunciation, association*, &c. The compound consonant *j*, also, was originally nothing else but the vowel-consonant *i* or *y*. The influence exerted by this vowel-consonant on any preceding consonants will be investigated more minutely in a subsequent chapter (Chap. X).

[Rem.—This view concerning the vowel-consonants *w* and *y*, is corroborated by Dr. Brücke. He says, page 70:

"Most consonants are formed in such a manner, that the conditions under which they are produced, cannot be combined with those under which vowels are generated; however, of this there are two singular exceptions.

"If we, in the pronunciation of *u* in *flute*, narrow the contracted opening of the mouth to such a degree, that a *fricative sound* is produced, the sound thus formed corresponds to w^1 [Dr. Brücke's notation], accompanied by the voice; the voice, however, retains the sound of *u* in *flute;* thus the vowel *u* in *flute* and the consonant w^1 are really produced at the same time. This sound, which I shall express by the formula uw^1, is no other than the English *double U*, when it is used as a consonant, *e. g.* in *water*.

"If, on the other hand, we pronounce *i* in *machine*, and diminish the space between the tongue and the palate, where it is narrowest, still more, we produce the *I consona* of the Germans, this being the very place where y^1 [a guttural or rather palatal breathing, according to Dr. Brücke's notation] is articulated. In this process the vowel-sound of *i* in *machine* is not lost, but it is heard at the same time with the consonant y^1. I shall express this sound by the formula iy^1. This sound is best illustrated by the *wy* of the English, where it is a consonant." . . . . .]

CHAPTER III.

ON DIPHTHONGS.

§ 8. In order to explain the nature of the diphthongs it first becomes necessary to employ specific signs for the expression of each of the vowel-sounds which are their constituent members. For the representation of the five general vowel-sounds, *a* in *father*, *a* in *age* or *e* in *edge*, *i* in *machine*, *u* in *flute*, and *o* in *note*, the German characters, ɑ, ɛ, i, ɯ, o, will be employed, and for the particular vowel-sound, *a* in *all*, and the unmodified vowel-sound, the signs a° and ɔ, which have been previously introduced.

The *diphthongs* are generally described as two vowels, consecutively pronounced in such a manner as not to constitute two but one syllable. In order to produce this result, it is necessary that one of the two vowels be emphasized more than the other. But, if we take into consideration that two vowels can never be so pronounced as to form one syllable, unless in their pronunciation one vowel should

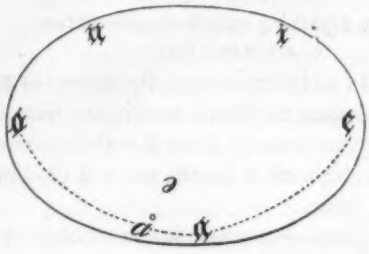
gradually pass over into the other by means of intermediate links, we see at once that the diphthongs are really nothing else but segments of the vowel-line. These segments may extend from one general vowel-sound to another, or still farther from a particular to a general vowel-sound; but, in no case do they include any other but two *consecutive* vowel-sounds. Furthermore, all diphthongs tend from those vowel-sounds which are pronounced with the tongue comparatively at rest, to those where the tongue is raised; consequently, the first members of all the diphthongs are either ɑ, *a*°, or ə. From ɑ and *a*°, there is a transition either to ɛ or ɔ as their second members, and from the primitive vowel ə to i or ɯ. The reason why the diphthongs never tend from i or ɯ downwards, is because when the vowels i or ɯ are pronounced before any other vowels, their consonant nature is developed, and they are for this reason rendered unfit for the production of pure diphthongs. However, the vowel-sounds i and ɯ form a sort of diphthong among themselves, by the vowel-sound i being pronounced quickly before ɯ, as in *cue* and *few*. But this diphthong differs from the rest in this particular, that its second and not its first member is emphasized. Moreover, its first member is liable to be converted into a sibilant when preceded by *t* or *d*, thus proving that i is no longer a pure vowel, but a vowel consonant.

Before specifying the particular diphthongs formed in the manner aforesaid, I would observe that the term "diphthong," which, according to its general acceptation, signifies two vowels pronounced in such a manner as to form but one syllable, is misapplied by most English orthoëpists and lexicographers in their calling every combination of two vowels a diphthong, whether it is used to express one simple vowel-sound or two. So *ai* in *mail*, *ea* in *bead*, &c., are called diphthongs, but they are no more diphthongs than *a* in *male*, or *e* in *Bede*.

[Rem.—Fowler in his English Grammar, § 64, indeed, says: "Compound sounds, formed by means of two vowel-sounds, are called diphthongs;" and afterwards he remarks: "Some of the vowel-sounds do not readily combine, as those of *e* and *a* in *beat*. Only one of the elements is sounded. When two vowel letters are thus brought together in a written word, and the sounds which they represent will not combine, they are called a *digraph*." I shall make use of this term of Professor Fowler in all cases where two vowels are employed in the English language to represent single sounds, and I shall not only use it in such cases where, according to Prof. Fowler, the two vowel-sounds do not readily combine, but also where they might combine and yet only represent single sounds, as *ai* in

mail (which is a genuine diphthong in German), *ou* in *to pour*, &c. With the vowel-sound ɑ as their first member, two diphthongs are formed, 1, ɑɛ; 2, ɑo; as is shown in diagram 1.

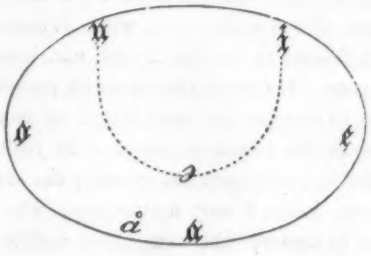
1.



The diphthong ɑɛ is considered in the English language as the long sound of the vowels *i* or *y*, and is accordingly spelled *i*, as in *child*, *ie* as in *pie*, *y* as in *fly*, or *igh* as in *high*. The diphthong ɑo is spelled either *ou* as in *spouse*, or *ow* as in *fowl*.

In order to make the vowel-sounds i or u termini of diphthongs, we have recourse to the unmodified vowel-sound, which is as near to them as to any other vowel-sound, and, accordingly, we obtain the following diphthongs, viz., əi and əu, as in the diagram 2.

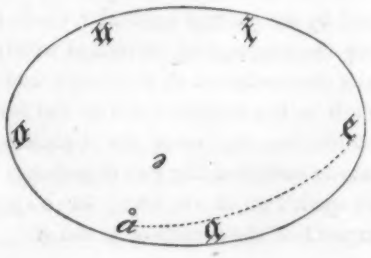
2.



These two diphthongs are higher powers of the two former, and are expressed by the same signs in writing. The diphthong əi is spelled *i*, *y*, or *igh*, as in *blithe*, *scythe*, and *night*. The diphthong əu is spelled in the same way as the diphthong ɑo, viz., *ou* in *gout*, *stout*.

Of the vowel-sound *a*°, only one diphthong is in use in the English language, viz., a°ɛ, as appears from diagram 3.

3.



This diphthong is either spelled *oi* as in *toil*, or *oy* as in *boy*.

There are accordingly five pure diphthongs in use in the English language, to which we may add as a sixth the impure diphthong iu in *cue*, *few*, &c., as may appear from the following table:

I. *Diphthongs with the vowel-sound* a.

1. aɪ in *file, pie, high, fly.*
2. aʊ in *spouse, fowl.*

II. *Diphthongs with the vowel-sound* ɔ.

3. ɔɪ in *blithe, scythe, night.*
4. ɔu in *gout, stout.*

III. *Diphthong with the vowel-sound* a°.

5. a°ɪ in *toil, boy.*

Impure Diphthong.

6. ɪu in *cue, few, union.*

In addition to these diphthongs in use in the English language, we find some additional ones in the German language, with the particular vowel-sounds ö and ü as their second members. With the former we obtain aö in Freude, and a°ü in Bäume, &c., and with the latter ɔü in Leute.

[Rem.—A great disagreement has heretofore prevailed among the phonologists with regard both to the particular ingredients of each diphthong, and the manner in which the transition from the first into the second members is effected, and I hope that the present investigation which undertakes to settle some of these difficulties will be deemed satisfactory.

Much confusion in determining the particular ingredients of each of the diphthongs has been caused by the phonologists not distinguishing between the sounds of *i* in *file* and *sight*, and of *ow* or *ou* in *howl* and *stout*. Walker holds that the first member of the long sound of *i* is *a* in *father*, while Webster contends that it is neither *a* in *father*, as Walker thinks, nor, indeed, *aw*, as Sheridan seems to suppose. He holds that it is not possible, by any characters we possess, to express the true sound on paper; that it is not formed so deep in the throat as *aw* or *a* in *father;* that the position of the organ is nearly, yet not exactly, the same; and that its true sound can be learned only by the ear. Dr. Webster is evidently trying here to describe the unmodified vowel-sound, which combines all the conditions he lays down. This sound had not yet been recognized by the orthoëpists at his time. The fact is, that Walker analyzed the sound of *i* in *file*, where *a* in *father* is the first member; and Dr. Webster that of *i* in *sight*, where the unmodified vowel is the first member; and then, both extending their own results, which they obtained by analyzing a particular shade of the diphthong, to the diphthong in general, they arrived at widely different results with regard to the pronunciation of the long sound of *i*. Even Dr. Brücke, although he has a correct idea of the manner in which the transition from the first member of the diphthong into the second is effected, seems to confound the two diphthongs in *howl* and *gout*, which are both spelled au in German; for he considers this diphthong really composed of the sounds of a and u.

Latham, in his "Elementary English Grammar," § 38, holds that the diphthongs are formed by the union of a vowel, and the semi-vowels [or rather vowel-consonants] *w* and *y*. It is true, that when some of the diphthongs are pronounced by themselves, or at the close of a word, as in *how* or *high*, a slight consonant breathing is heard, as in the vowel-consonants *w* and *y*. But of this we do not perceive the least trace when they are pronounced in the middle of a word, as in *gout* or *height*. This consonant breathing, moreover, is only heard in those diphthongs which terminate in i and u, and it is not heard at all in those which end in e or o, as in *pie* and *bow*. This circumstance we adduce as another proof of the distinction which exists between the two kinds of diphthongs.

With regard to the particular process in which the two vowels are blended into a diphthong, Dr. Latham makes the following remarks in his work on "The English Language," § 89: "*The nature of the modification that the component parts of a diphthong undergo, has yet to be determined*, although it is certain there is one. If it were not so, the articulation would be double, not compound." Concerning this modification, Dr. Brücke says in his answer to Prof. Kudelka, page 30: "During the process of the formation of the diphthongs, the resonance of the vowel in the cavity of the mouth, in passing from the first to the second members, is continually changing. Thus in the pronunciation of au [English, *ou* or *ow*], the resonance of the vowel, in the cavity of the mouth, passes through a series of intermediate sounds, which, according to my system of notation, I might represent by the signs *a*, *a*°, *o*, *o**, *u*; but, inasmuch as the parts of the mouth are continually changing, none of these vowels are distinctly expressed. Hence the great diversity of opinions entertained with regard to the proper spelling of the diphthongs; hence, also, the necessity of pronouncing a diphthong very slowly, or to sing it, in order to detect their first and second members."

R. von Raumer (Ueber deutsche Rechtsdreibung, page 62) notices two modes of forming a diphthong. The first consists in pronouncing each of the two vowels distinctly in succession, without marking the intermediate sounds. By laying the stress only on the first vowel, we are enabled to pronounce both of these vowels in one syllable, but they are merely conjunctions of two vowels, and cannot be called diphthongs. This is the mode in which the diphthongs are pronounced in the Italian and Spanish languages. In the second mode, the transition of the first vowel into the second is not effected instantaneously, but gradually; and during the whole period in which the position of

the mouth is altered, the vocal breath is allowed to pass through it. Thus an indefinite number of intermediate vowel-sounds are produced between the first and second members of the diphthong, merging into one another. At last, even the very initial and final vowel-sounds of the diphthong may be rendered indistinct, so that nothing remains except the transition from one of the vowels into another. Of the diphthongs formed in the second manner, we can very easily get an idea by pronouncing slowly the words *mild* and *loud*. (*Jacobi*, Beiträge, page 42.)]

CHAPTER IV.

ON THE DISTINCTION BETWEEN THE SEMI-VOWELS AND CONSONANTS.

§ 9. The semi-vowels and consonants are the exact antithesis of the vowels. The vowels, as has been mentioned above, are the animating principle of words, and the semi-vowels and consonants their formative principle. The modulation of the vowels is commenced in the pharynx, and continued in the cavity of the mouth; but the articulation of the semi-vowels and consonants is effected in the cavity of the mouth alone, and the pharynx has no share in their formation.

In addition to the general arguments advanced above in favor of separating the semi-vowels and consonants, I now submit the following to the judgment of the reader.

The semi-vowels and consonants together constitute the formative element of words, but physiology as well as etymology prove them to be distinct classes of sounds. The difference between the two consists in all the *semi-vowels* being pronounced with sonorous breath, while the generality of *consonants* is formed of mute breath; also the *semi-vowels* occupying an independent position with regard to each other, and generally retaining their individual nature in passing from one language into another, while the *consonants* are divided into three classes, according to the region of the mouth in which they are articulated; and the members of each of these classes are found regularly to interchange with each other in the Arian languages, in being transplanted from an older into a more modern language. Moreover, the *semi-vowels* may, with propriety, be called *general sounds*, because they cannot be modified, *i. e.*, because no other sound

can possibly be pronounced when the mouth is disposed for their pronunciation, while the *consonants* may be denominated *particular sounds;* because, in the same places where one consonant is formed, others also may be articulated. For instance, the semi-vowel *m*, and the consonant *p*, are both formed in the region of the lips; the former by throwing back the sonorous air from the lips, and discharging it through the nose; and the latter, by forcing the breath through the closed aperture of the lips. Now, in throwing back the air from the lips and discharging it through the nose, it is impossible to obtain any other sound than that of the semi-vowel *m*, but in suffering the air to escape through the lips by relaxing or increasing the pressure and modifying the breath, we get the various consonants *p*, *b*, *f*, and *v*, and the vowel-consonant *w*. Such is also the case with the remaining semi-vowels and consonants. Lastly, an additional proof of the organic difference between the consonants and semi-vowels is derived from the function which the latter fulfil in the composition of words; for there, as we shall see hereafter (Chapter IX), they serve as mediums through which most of the consonantal combinations with the vowels are effected.

For the reasons here stated at large, I propose to separate the semi-vowels entirely from the consonants, and to treat each as a separate element of speech.

CHAPTER V.

ON THE CONSONANTS.

§ 10. In the cavity of the mouth there are three different stations assigned to the articulation of the consonants. Each of these stations consists of a gate which may be opened or shut at pleasure. The *first* or outer gate is closed by pressing the lips together, or pressing the lower lip against the upper teeth; the *second* or middle gate by pressing the tip of the tongue against the hard palate, the upper gums, or the upper teeth; and the *third* or inmost gate by pressing the middle of the tongue against the hard and soft palates in the posterior part of the mouth. The consonants which are formed in the first station are usually called *labials*, those in the second station *dentals*, and those in the third station *gutturals*.

[Rem.—The greatest diversity prevails among the phonologists with regard to the number of stations for the articulation of the consonants;

most of them being in favor of *three*, others again of *four* (Sproat), or *five* (the Sanscrit grammarians, R. v. Raumer, Kudelka, Ellis), or *seven* (Lepsius, du Bois de Reymond), and Purkine even in favor of *ten*. Dr. Brücke's argument in favor of only three stations I think conclusive. He says in his answer to Prof. Kudelka, page 16: "This division is well founded in the sudden change which the acoustical character of the mutes experiences at the boundaries of each station. In the first station the mutes are *p* and *b*; throughout the whole extent of the second station, until we arrive at the precinct of the third, we obtain *t* and *d*, and again, throughout the whole of the third station we get *k* and *g* and no other mutes."

The same confusion prevails with regard to the names given to each of these stations by the phonologists and grammarians, and in order to give to the reader some idea of this confusion, I propose to submit a scheme of the terminology employed by the various advocates of three stations:

	1st station.	2d station.	3d station.
Max Müller, ...	labials,	dentals,	gutturals.
Dr. Kraitsir (Nature of Language), ...	labials,	lingual-dentals,	gutturals.
Prof. Harrison (Latin Grammar), ...	labials,	linguo-palatals or linguo-dentals,	gutturals.
Corssen (Aussprache, Vocalism, &c., d. Lat. Sprache), ...	labials,	linguals,	gutturals.
J. Wallis and *Chladni*, .	labiales,	palatinæ,	gutturales.
Prof. Heyse (System d. Sprachw.), ...	labials,	dentals,	palatals.
Andrews and *Stoddard*, (Latin Grammar), . .	labials,	linguals,	palatics.
Fowler (English Grammar); the sibilants he calls dentals, . . .	labials,	linguals,	palatals.
Dr. Bruch (Zur Physiologie der Sprache), .	labials,	linguals,	faucales. (Rachenlaute.)

From this scheme it may be seen that almost every phonologist and grammarian has his own terminology. I do not consider it worth while to alter those terms which are in general use, viz., *labials, dentals, gutturals;* although none of them describe any of the stations

accurately. For, in the formation of the labials, not only the lips but also the upper teeth are active; in that of the dentals, besides the teeth, the palate and the tongue have an important part; indeed, in the pronunciation of some of the consonants of the second station the teeth have apparently no share whatever. Hence, as may be seen in the above scheme, some of the phonologists call the consonants of the second station palatals or linguals, or also linguo-palatals or linguo-dentals, and still others (Sproat), gingivals or linguo-gingivals; yet, not a single one of these terms is free from objections; for the tongue and the palate are as much active in the formation of the so-called gutturals, as in that of the dentals; hence, the gutturals too, are called palatals by some. However, inasmuch as no short, convenient term can be found, which combines all the attributes of each station, I think that we can do no better than to retain the old terms which single out one of the leading characteristics of each station, viz., the *labials* the lips, the *dentals* the teeth, and the *gutturals* the throat. The last of these terms seems the most objectionable, inasmuch as the so-called guttural consonants have nothing at all to do with the throat proper; but as the term *throat* has usually a very vague meaning, and is frequently applied to anything that has reference to the back part of the mouth, I deem myself justified, on this ground, to retain this appellation. Dr. Brücke obviates all these difficulties by calling the labials, consonants of the first order, the dentals, consonants of the second order, &c. Still, it is desirable that we should have short, convenient words for this purpose.]

§ 11. In each of the three stations, described above, three kinds of consonants may be produced, differing from each other in degrees of solidity, and which may be called hard, soft, and fluid consonants. The *hard consonants* are formed by keeping the gates firmly shut and exploding them with a blow; the *soft consonants* by relaxing the pressure and forcing them open by breathing; and the *fluid consonants* by keeping the gates ajar, or only keeping them partially closed, thus allowing an uninterrupted passage to the blow or breathing, and yet imprinting upon it the characteristic nature of each station. Of the *hard consonants* there is only one species, because they are blown, and a blow, in the articulation of the consonants, is never accompanied by the sound of the voice; but of the *soft consonants* we have two kinds, viz., such as are formed of mute breath, and such where the breath is rendered sonorous on passing through the glottis. Of the *fluid consonants*, finally, we have three species, because they may either be formed by blowing, or by breathing, and

when they are formed by breathing they may either be pronounced with mute or sonorous breath.

Such of the fluid consonants as are breathed and at the same time rendered sonorous, bear much resemblance to the semi-vowels, but they lack some of their most important attributes; for they are still linked to the consonants, composing their respective classes, and are subject to changes by transplantation into other languages; moreover their range is limited, and they do not occur in all languages, and, where they do occur, they cover but a small ground, compared with that which is filled by the semi-vowels; it seems as if they were the highest points reached by the consonants in their desire of emulating the semi-vowels and vowels.

Besides these changes of the fluid consonants which are obtained by modifications of the breath, there are others which are caused by shifting the places of articulation; of these I shall speak hereafter.

The relations existing between the hard, soft, and fluid consonants are the same as between the points of a circle; for Comparative Philology shows that in the progress of time the fluid consonant is made soft, the soft hard, and the hard fluid, thus establishing the fact that the hard consonant is equidistant from the soft and the fluid, *e. g.* in the Anglo-Saxon portion of the English tongue, which represents an early stage of the German language, we find the words *bath*, *word*, and *water*, which in the modern German are spelled *Bad*, *Wort*, and *Wasser*, &c. A similar change happens to the vowels in the two languages, with this difference, however, that it is the German language which usually holds fast to the original vowels, while it is the English that varies them. Thus it happens that sometimes where in German we find *a* in the English language we find *e*, *o*, *i*, and *u*, viz., Germ. *Rast*, Engl. *rest;* Germ. *halten*, Engl. to *hold;* Germ. *flackern*, Engl. to *flicker;* Germ. *flattern*, Engl. to *flutter*. On comparing the changes of the vowels with those of the consonants, we find that the latter are more limited in their changes than the former; for the consonants can only move from right to left, *i. e.* the fluid consonant (th) can only be changed into the soft consonant (d), but not into the hard (t), while the vowels can move both to the right and to the left. Comparative philology, moreover, proves that the three circles which are formed by the labial, dental, and guttural consonants are perfectly independent of each other and only rarely interchange, so that, as a general thing, a labial does not become a dental, nor a dental a guttural, although it sometimes happens that through the agency of the vowel-consonant *y* a guttural

or a labial becomes a dental; besides a few other interchanges of consonants of different classes, noticed by comparative philology. While, therefore, all the vowels together form one circle or oval, which may run either from left to right or from right to left, the consonants form three separate circles, all of which run only from right to left.

[REM.—The same discordant views which we notice among the phonologists and grammarians with regard to the definition of the particular stations in the vocal tube where the articulation of the several consonants is effected, and in their manner of naming them afterwards, we observe in the account which they give of the formation of the several consonants in each station and in the names which they give to them.

With regard to the difference between the hard and soft consonants, Dr. Brücke says, page 55: "In all the systems elaborated by linguists who have studied comparative phonology, the soft consonants have been classed among the sonant letters, because phonetically they are as much related to the sonant fluid consonants, as the hard consonants are related to the non-sonant fluid consonants; still some of them hesitate to class them among the sonant consonants, because at one short period of their articulation the voice is intermitted. However, in some instances, the voice really continues to sound after the station has been closed, and, whenever this is not the case, the glottis is still contracted and ready to vibrate, which is never the case with the non-sonant consonants. The reason why the voice in the pronunciation of the soft consonants really does cease, is because the difference in the pressure of the air in the chest and in the cavity of the mouth is not sufficiently great to cause a current of air by which the glottis may be rendered vocal. During the entire duration of the closing of the station, in the pronunciation of the soft consonants, the glottis is ever ready to vibrate, and, therefore, as soon as the station is opened the voice continues to sound in the same way as it did before it was closed. This is the essential difference between the pronunciation of the hard and soft consonants." In support of his argument Dr. Brücke gives an account of the interesting manner in which the modern Greeks transcribe the soft consonants. The old Greek soft consonants β and δ, in the course of time have become fluid, and the ancient β is pronounced by the modern Greeks like *v*, and δ like *th*. In order, then, to represent the soft consonants in their language, in the case of the labial soft consonant, they take the sonant labial semi-vowel μ, which is pronounced with the glottis contracted, and place it before the hard

consonant π; by pronouncing them quickly in succession the hard consonant π is made soft, and the semi-vowel μ is almost reduced to the indistinct sound which is heard before the English soft consonant in *sob*, *tub*, &c. The same thing is done in the case of the dental soft consonant, where the semi-vowel ν is placed before τ, viz., $\nu\tau$.

Dr. Brücke continues: "The contraction of the glottis so as to be ready to vibrate, thus constitutes the essential difference between the soft and hard consonants; all other distinctions are adventitious and thus unessential. It has been maintained that the soft consonants are distinguished from the hard by being exploded with a milder force, and that this fact can be noticed by holding the hand opposite to the mouth and alternately pronouncing the hard and its corresponding soft consonant. That in the pronunciation of the hard consonant, in this case, a forcible breathing is ejected against the hand, which is scarcely observed at all in the pronunciation of the soft consonant. Again, that if, in exploding the hard consonant, you lay your hand on your breast, you feel it collapse suddenly, which is not the case in the pronunciation of the soft consonant. All this is true, but these are merely incidental matters. In pronouncing the soft consonants, the glottis is contracted, so as to be ready to vibrate, and a sudden rush of the air from the lungs is thus prevented, even after the station has been opened; but in the pronunciation of the hard consonant, the glottis is wide open, and hence the sudden and violent gush of air from the lungs upon the opening of the station, and hence also the corresponding collapse of the chest. Suppose that the difference between the hard and soft consonants merely consisted in the manner of their explosion, this distinction would be lost entirely upon their being pronounced before their corresponding nasal semi-vowels; for in this case they are, indeed, sounded, but not exploded, and the distinction between them is, nevertheless, clearly observed, as in the English words *midshipman* and *club-man*. It has also been maintained that the essential difference between these two kinds of sounds consisted in the station being closed more firmly in the pronunciation of the hard than in that of the soft consonants. This is usually the case, but it is likewise merely an incidental matter. In the pronunciation of the hard consonants the glottis is wide open; the pressure of the air is thus the same in the cavity of the mouth as in the lungs, and the station must, therefore, be closed with sufficient firmness to resist this pressure. But the case is different in regard to the soft consonants; in their pronunciation the glottis is

contracted, that is, the vocal ligaments meet almost, and are only separated a little by the current of air which causes them to vibrate. In case the station is closed, with the glottis contracted in this manner, it need not be shut so firmly, inasmuch as the air is pressed more slowly into the cavity of the mouth while the glottis is vibrating, and therefore the pressure there is increased only very slowly. As the station, moreover, is shut but for a very short time in speaking, there is no need of closing it as firmly in the pronunciation of the soft consonants as in that of the hard consonants. However, no matter how firmly the station is closed, whenever it is opened while the glottis is sounding, the soft and not the hard consonant is produced; and no matter how tightly it is closed, whenever the glottis is wide open the hard and not the soft consonant is obtained."

With regard to the sonant and non-sonant nature of the soft and hard consonants, R. von Raumer makes the following remarks (Zeitschrift f. d. Œsterreich. Gymnas. 1858, Heft 5, page 355): "The distinction between sonant and non-sonant consonants, which was already known to the ancient Sanscrit grammarians, is an excellent criterion, ... but, inasmuch as the sound of the voice in the pronunciation of the soft consonants is merely an incidental and not an essential element, it may be well to investigate the cause why the voice combines with some sounds but refuses to do so with others. This cause is no other than that certain sounds are produced by *blowing* and others by *breathing*. Blowing excludes all sound, but breathing invites it." After thus stating the opinions of two of the highest authorities in matters connected with phonology, I shall investigate the subject myself, and see how my own results agree with those of these two gentlemen. First of all I propose to explain the distinction between the German and English soft consonants.

The fact that the Germans pronounce their soft consonants differently from the Americans may be noticed daily in this country, where we frequently hear "*goot morning*," "*Got*" instead of *God*, and "*hock*" instead of *hog*, from the lips of the former. The reason of this is that the Germans pronounce their soft consonants with mute breath, and these sounds, unless followed by vowels, are perfectly inaudible; wherefore, in order to insure their being heard at the end of words, they must needs be changed into their corresponding hard sounds. The German *b*, thus, at the end of words, is changed into *p*, the German *d* into *t*, and by the southern Germans, this analogy is also carried out with respect to the consonant *g*, which, at the end of words, they change into *k*, while the northern Germans

soften it into the German *ch*. The English soft consonant being formed of sonant breath, is heard at the end of words, as well as at the beginning and in the middle. It hence appears that the English soft consonant is a completer articulated sound than the German, because it preserves its character as a soft consonant throughout, while the German, at the end of words, passes into the hard consonant. The Germans, moreover, make no distinction between *p* in *midshipman* and *b* in *abmahnen*. Falkmann (Declamatorik, Hannover, 1836, vol. i, page 192), says concerning this subject: "It is almost against the nature with us Germans to pronounce a soft consonant at the end of a word, and with great difficulty we imitate the final *b*, *d*, *g*, and even the soft final *s* of the English (*tub*, *bed*, *fog*, *was*). . . . . We think that it would be an advantage for the Germans if, in the pronunciation of their own tongue, they would imitate the sound of the soft consonants of their English cousins."

A peculiarity of the English soft consonants consists in the indistinct sound which is heard before them, either in the beginning or at the end of words; at the end of words, as in *tub*, *bed*, *fog*, &c., it is even heard more distinctly, because it is not absorbed there by a following vowel. This indistinct sound is produced by the air from the lungs being rendered sonant by rushing through the contracted orifice of the glottis, and collecting in the back part of the mouth. By opening the station and discharging through it the air collected in the back part of the mouth, when it is on the point of becoming mute, the sound of the English soft consonant is produced. There are accordingly three elements conspiring in the production of the English soft consonant: 1, the glottis vibrating so as to make the air rushing through it sonant; 2, the collection of the sonant breath in the back part of the mouth; 3, the closing and opening of the station. The manner of closing and opening the station does not differ much in the pronunciation of the hard and soft consonants, but we must investigate the influence which the other two elements exercise upon the formation of the latter sounds. As the distinction between the hard and soft consonants is as much observed in the whispering language (*vox clandestina*) as in the loud language, we see at once that the sonant element is not essential; neither does Dr. Brücke exactly hold this, he only insists that in the pronunciation of the soft consonant the glottis is contracted, so as to be ready to vibrate. As regards the second element, viz., the retention of the breath in the back part of the mouth, it is produced by the pressure of the root of the tongue

against the palate. The fact of the air being there retained is made very evident in the pronunciation of *b*, where the sonant air is collected in the mouth without its inflating the cheeks at all, as in the pronunciation of *p*. The use of this retention of the air seems to be to prevent the full force of the column of air from the lungs to press against the closed station, and it acts thus as a sort of regulator of the breath. In fact this retaining of the breath *by any* of the vocal organs, either by the lungs themselves or the glottis, or the anterior or posterior parts of the mouth, instead of allowing its full force to bear against the closed apertures of the vocal tube, as in the case of the hard consonants, I regard as the chief characteristic of the soft consonants, and as their principal distinction from the hard. In proof of this I adduce the German language, where the sole distinction between the hard and soft consonants consists in the lesser weight of air brought to bear against the closed stations, else the soft consonants could not be changed into their corresponding hard consonants at the end of words by simply increasing the pressure of the air in their pronunciation. Still, in thus making the leading characteristic of the soft consonant to consist in the lesser weight of air brought to bear against the closed station, I do not, on this account, object to the explanations of Dr. Brücke and R. von Raumer, as may be seen from what follows: I only object to the generalization of the former in making *all* soft consonants sonant.

My position will become more evident by the following investigation into the nature of the consonants in general.

There are three elements conspiring in the pronunciation of the consonants: 1, the air from the lungs; 2, the disposition of the glottis; 3, the manner in which the articulating stations in the vocal tube are disposed. Each of these elements undergoes various modifications during the pronunciation of the consonants. R. von Raumer makes the modifications of the air itself the criterion of a division of the consonants, Dr. Brücke those of the glottis, and I the different dispositions of the various articulating stations. *The articulating stations* modify the breath passing through them, and are modified by it in return. They modify the breath in a twofold way, by either being kept closed or left ajar; and when they are kept closed they are again affected by the opposing breath in a twofold way, viz., the breath can either press against the closed station in a very forcible manner, or else more mildly; in the former case the stations are closed more firmly, and in the latter case more lightly. There are thus altogether three modifications in the arrangement of the articu-

lating stations, accordingly as they are either firmly or lightly closed, or left ajar. In the first instance the *hard consonants* are produced, in the second the *soft*, and in the third the *fluid*. As regards the modifications of *the air* itself, it can either be ejected from the lungs as a blow or as a breathing. When the air is blown out from the lungs we obtain *the hard consonants* and *the blown fluid consonants*, and when it is breathed out *the soft consonants* and *the breathed fluid consonants*. In blowing, the *glottis* is wide open, but in breathing it has a tendency to contract. Nor is the glottis the only part of the vocal tube which has a tendency to contract in breathing. The radical difference between blowing and breathing is this: In blowing, all the apertures, from the inmost parts of the lungs to the mouth itself, are stretched open, and the air is suddenly ejected by a contraction of the muscles of the chest; but in breathing there is no such forcible opening of the organs, but they are left in their usual state, and the air is gradually and almost insensibly expressed. In blowing we notice a distinct effort made towards opening the organs of speech, but in breathing the only tendency which we notice in the organs is that of being left alone. While in blowing, therefore, the glottis is stretched wide open, so as not to interfere in the slightest degree with the rushing out of the air; in common breathing, although the glottis is still open, it nevertheless has more of a tendency to contract, and thus of preserving its original quiet state; and thus while by an intensified blowing the glottis is stretched more and more open, this being the original tendency of a blow, by an intensified breathing the glottis is more and more closed, this being the original tendency of a breathing. In the motion of the air which is called blowing, there are indefinite degrees of rapidity; when it is reduced to its minimum degree of rapidity, so as to resemble a breathing, we obtain by it the German soft consonants, which are *the non-sonant soft consonants*. In breathing, also, we notice various degrees of velocity; in common breathing, when the current of air moves slowly from the lungs, the glottis does not vibrate, and the breathing is mute; but when it moves more rapidly the slight noise is produced which is heard in the whispering language, and when the speed of the current is still more increased the glottis begins to vibrate and the breathing is made sonant, as in sighing, singing, speaking. When the soft consonants are pronounced with sonant breathing we obtain the English or *the sonant soft consonants;* when we pronounce the fluid consonants with the slight noise of the whispering language, we produce *the non-sonant, breathed fluid consonants*, and when we pronounce

them with the sonant breathing *the sonant fluid consonants*. There are thus 1, hard consonants which are blown; 2, sonant soft consonants which are breathed, and non-sonant soft consonants where the blow is reduced to the minimum degree of its velocity and resembles a breathing; 3, fluid consonants which are blown, and sonant and non-sonant consonants which are breathed.

As regards the order in which the consonants, generated in each of the articulating stations, are presented by the various phonologists, I propose to exhibit the systems of each in the following schemes, commencing with my own:

I.	II.	III.	
HARD CONSONANTS.	SOFT CONSONANTS.	FLUID CONSONANTS.	
= blown.	= breathed.	1.	2.
	a) sonant.	*blown.*	*breathed.*
	b) non-sonant.		a) sonant.
			b) non-sonant.

2. Prof. *von Raumer's* scheme (Zeitschrift f. d. oesterreichischen Gymnasien, Jahrgang ix, Heft 5, page 357):

I.		II.	
EXPLOSIVE SOUNDS.		CONTINUOUS CONSONANT SOUNDS.	
(Verschlusslaute.)		(Konsonantische Dauerlaute.)	
a.	*b.*	*a.*	*b.*
blown.	*breathed.*	*blown.*	*breathed.*
(flatæ)	(halatæ)	(flatæ)	(halatæ)
[= non-sonant]	[= sonant]		

3. *Dr. Brücke's* scheme (pages 30, 55, &c.):

I.		II.	
EXPLOSIVE SOUNDS.		FRICATIVE SOUNDS.	
(Verschlusslaute.)		(Reibungsgeräusche.)	
a.	*b.*	*a.*	*b.*
non-sonant.	*sonant.*	*non-sonant.*	*sonant.*

The object of reducing the consonants generated in the various articulating stations into a system, may either be to exhibit their mutual relations, or to give a synopsis of the elements conspiring in their formation. The history of language reveals the relations between the several consonants, by tracing the changes which they undergo in the course of time, and upon being transplanted from one

language into another, the presumption being that these changes are brought about according to the degree of affinity existing between the several sounds; but the materials for a synopsis of their constituent elements are furnished by physiological researches. Physiology cannot decide the question as to the relations of the consonants, as little as philology can give us a clue to their formation; therefore, in order to construct a consonant system exhibiting both the relations and the component elements of the several consonants, physiology and philology must combine, the former furnishing the materials and the latter arranging them into a proper form. These preliminary remarks are necessary to enable me to discuss the differences between my own scheme and those of R. von Raumer and Dr. Brücke.

The schemes of Dr. Brücke and R. von Raumer give us a synopsis of what each considers to be the elements of the several consonants,—they are merely physiological schemes. In my own scheme I undertake to supply their deficiencies and to arrange the consonants into true philological order. The nature of the deficiencies supplied, appears on a comparison of my scheme with that of the others. As regards the true relations of the several consonants in each station, comparative philology recognizes three degrees of solidity among them, which I call *hard*, *soft*, and *fluid*. These three degrees, this science proves to have been changed, in the course of time, in such a manner that the fluid consonants were made soft, the soft hard, and the hard fluid; this has been instanced above, and it has, moreover, been stated that the relations existing between the hard, soft, and fluid consonants are the same as between the points of a circle. I can, therefore, present my scheme of consonants, also, in the following diagram:

The philological arrangement differs from the physiological in this respect, that the former makes a separate degree of the soft consonants, while the latter classes them with the hard consonants under one head, and while comparative philology teaches that the breathed and blown fluid consonants *together* constitute one degree, and that both are related to the hard and soft consonants in a like manner, the physiologists are inclined to maintain that the

breathed fluid consonants are especially related to the breathed soft consonants, and the blown fluid consonants to the blown hard consonants. The fact that the blown and breathed fluid consonants are found in the same degree is proved also by this consideration, that in the English and French languages these two consonants frequently interchange in the same words, e. g. *half* and *halves*, *life* and *lives*, *neuf* and *neuve*, &c. That this arrangement of the consonants into three degrees is also based on physiological grounds, I have proved above, where I have shown that in the pronunciation of the consonants the articulating stations are modified in a threefold manner. This division has also been observed by the old grammarians, who have divided the mutes into *tenues*, *mediæ*, and *aspiratae*. The translation of these terms, in some of our modern grammars, is *smooth*, *middle*, and *aspirate*. The term "*smooth*" I regard as an unfortunate translation, inasmuch as the hard consonants might with more propriety be called rough instead of smooth; the term "*middle*" is better, but the term "*aspirate*," in Greek grammar, is limited to a few fluid consonants only, viz., φ, χ, ϑ, and ς or σ is excluded from it, and classed either with the semi-vowels, or else is made into a separate class and called a *sibilant*. I adopt the terms "*hard*, *soft*, and *fluid*," because in common language they describe three degrees of solidity; "*hard* and *soft*," moreover, are the general terms by which the smooth and middle consonants are indicated in German, and "*fluid*" recommends itself on the score of being a degree softer than "*soft*," and because, being a new term, we can easily include in it the aspirates as well as the sibilants. The schemes proposed by other phonologists and grammarians are generally based on mere physiological grounds, as may be seen from what follows.

Latham (English Language, 2d edit. page 127), divides the mutes into *lene* and *aspirate*, and each of them afterwards into *sharp* and *flat*. The sonant consonants he calls *flat*, and the non-sonant *sharp*, but he is at a loss himself (page 122) how to explain the difference between *lene* and *aspirate*.

Wallis (Grammatica Anglicana) divides the consonants into *muta* and *semi-muta* (non-sonant and sonant explosive sounds) and *aspirata* (fluid consonant), *subtilior*, and *pinguior*, each of which he subdivides into sonant and non-sonant.

Kempelen's division is like that of Dr. Brücke.

Dr. Joh. Müller speaks a, of consonants produced by *strepitus æqualis* seu *continuus*; b, by *strepitus explosivus*; these he subdivides

again into 1, *Explosivae simplices* (*b*, *d*, g); 2, *Explosivae aspiratae* (*p*, *t*, *k*).

Ellis has *explodents* and *continuants*, and *Lepsius*, *explosivae* or *dividuae*, and *fricativae* or *continuae*, and each of these he subdivides into *fortes* and *lenes*.

Prof. Max Müller (Bunsen's Outlines, &c., Vol. II, page 445), divides the consonants into *tenues* and *mediae*, and into *flatus sibilantes*, among which he distinguishes *asperi* and *lenes;* in addition to these he has both *tenues* and *mediae aspiratae*, following the Sanscrit grammarians.]

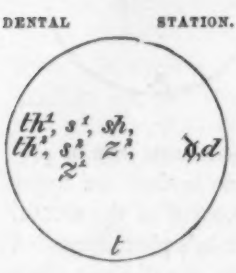
After these extended remarks on the nature of the hard, soft, and fluid consonants, I can proceed in my work, and specify the different consonants, generated in each of the articulating stations.

§ 12. In the *first* or *labial station* two series of consonants may be produced. This station is composed of the lips and the upper teeth, and can be closed either by pressing the lips together, or holding the lower lip against the upper teeth. In either case, by closing the station firmly and exploding it by a blow, we obtain the *labial hard consonant p;* by shutting it more tightly and opening it by breathing against it, we get the *non-sonant labial soft consonant* b in German, and by making the breathing sonant and collecting it in the back part of the mouth, before exploding the station with it, the *common labial soft consonant b* in English. The hard and soft consonants, produced by these two methods, viz., by pressing the lips together, or holding the lower lip against the upper teeth, scarcely differ from each other, but in their pronunciation the station is usually closed according to the first method, *i. e.* they are pronounced with the lips compressed; but the difference between these two kinds of consonants becomes apparent in the pronunciation of the fluid consonants. If we hold the lower lip loosely against the upper teeth and blow through the station, when thus disposed, we get the *fluid consonant f*, by breathing through it the German *fluid consonant* w, and by making the air sonorous before breathing it through the opening, the English *fluid consonant v*. By pressing the lips loosely together, we obtain another series of fluid consonants; by blowing through the station we get a modification of *f*, which is nothing else but a common blowing. Dr. Brücke says that this *f* is used by many Germans in the pronunciation of *u* in *qu*, e. g. *Quelle, Quirl*, &c. By breathing the vowel-sound *u* in *flute* through the station, when thus disposed, we get the English *vowel-consonant w*, which has been described above. In the labial station we thus obtain the

following consonants (as exhibited in the accompanying diagram): 1, the hard consonant *p*; 2, the German and English soft consonants b and *b*; 3, the fluid consonants *f* and *v*, and the German fluid consonant w; in addition to this, we have the English *vowel-consonant w*, which I propose to place on the outside of the diagram, because it is a sort of intermediate sound between the labial consonants and the vowels.

§ 13. In the *dental station* three series of consonants may be produced, by either pressing the tip of the tongue against the upper teeth, or the upper gums, or finally against the roof of the mouth, as may be seen from figures 5, 6, 7, in Dr. Brücke's plate, appended to his work. By closing the station firmly, in any of these three places, and exploding it with a blow, we obtain the *hard dental consonant t*; by relaxing the pressure and exploding the aperture by breathing against it, the German *soft consonant* d, and by rendering the breathing sonorous before exploding the station with it, the English *soft consonant d*. The hard and soft dental consonants which are in use in the English language, are those of the second series, *i. e.* those which are formed by pressing the tip of the tongue against the gums; they are called *alveolar* by Dr. Brücke. The *cerebral t* and *d*, or those of the third series, are found in the Sanscrit, and the *dental t* and *d*, or those of the first series, according to Dr. Brücke, are used by some people in place of the alveolar. The difference between these three series, which is not distinctly marked in the hard and soft consonants, is more clearly exhibited in the fluid consonants; there the different shades are also expressed to some extent by separate characters in writing. *The fluid consonants of the first dental series* are obtained by holding the tip of the tongue against the upper teeth. By blowing through the interstices of the teeth, with the tongue in this position, we get the sound of *th* in *thunder*, and by breathing through them, with the air rendered sonorous, the sound of *th* in *the, this, leather*, &c. *The fluid consonants of the second dental series* are generated by holding the tip of the tongue against the upper gum in such a manner as to allow an egress to the air through the teeth. By blowing through this passage we get the sound of *ss* in *blessing* or *s* in *say*; by breathing through it the sound of *s* in *was*; and by rendering the air sonorous before breathing

through it, the sound of *z* in *zeal*. *The fluid consonants of the third dental series* are obtained by drawing the tongue a little farther into the mouth than is done in the pronunciation of *s*, and there lowering the posterior part of the tongue, so that it presents a somewhat concave surface to the opposing breath; by blowing against this surface, the rushing noise of the consonant *sh* is heard, and by breathing against it, and, at the same time, rendering the air sonorous, the sound of *z* in *azure*. In the dental station there are thus produced the following consonants (as is illustrated by the accompanying diagram): 1, the hard consonant *t*; 2, the German and English soft consonants ð and *d*; 3, the fluid consonants *th*¹ in *thunder*, *th*² in *this*, *s*¹ in *say* or *ss* in *blessing*, *s*² in *was*, *z*¹ in *zeal*, *sh* and *z*² in *azure*.

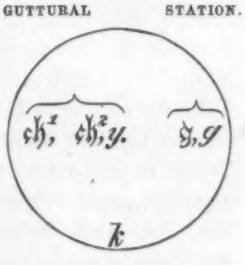


[Rem.—Dr. Brücke notices a fourth series of dental consonants, which is produced by pressing the tip of the tongue against the lower front teeth, while the middle portion of the tongue is held against the upper gum: this he calls the *dorsal* series; but the hard and fluid consonants there produced are but slight variations of the alveolar *t* and *s*, and they are, indeed, so much like them, that I do not deem it necessary to make a separate series of them.

I differ, also, from Dr. Brücke in his explanation of *sh*, which he holds to be an amalgamation of the guttural and dental fluid consonants; it is a clear dental letter and nothing else. I do not even hesitate to call it a dental letter, although in its pronunciation the tongue is drawn away from the teeth and touches the palate; for in pronouncing *sh* as well as *s*, the teeth are closed, while in the guttural consonants they are open.

§ 14. In the *guttural station* we obtain two series of consonants, by pressing the middle of the tongue either against the hard or soft palates (see figures 8 and 9 in plate). This circle is defective in the English language in some of its members. The *hard guttural consonant k* is produced by pressing the middle of the tongue against any part of the palate which it can reach, and exploding the closed aperture by a blow, just as the hard dental consonant *t* is formed by pressing the tip of the tongue against any part of the palate which it can reach, and afterwards exploding the closed aperture. By relaxing the pressure and exploding the station by breathing against it, we obtain the *German soft guttural letter* g, and by making the

breathing sonant before exploding the station with it, the *English soft consonant g*. Some of the fluid guttural consonants are wanting in the English language; they are produced by leaving the guttural door ajar, and either blowing or breathing the air through it. The *fluid consonants of the first series* are obtained by pressing the middle of the tongue against the hard palate, in such a manner as to allow an egress to the air. By blowing through the aperture thus obtained, we get the German consonant ch or χ in Nacht. By pressing the middle of the tongue against the soft palate in a like manner, and blowing through this aperture, we get the German consonant ch or χ in nicht; this is the *fluid consonant of the second series*. In addition to these, if, in the pronunciation of *i* in *machine*, we press the middle of the tongue more towards the palate, we get *the vowel-consonant y*, which is nothing else but a guttural fluid consonant, animated by the vowel *i* in *machine*, as has been shown above. In the guttural station we thus obtain: 1, the hard consonant *k*; 2, the German and English soft consonants g and *g*; and 3, the German fluid consonants ch[1] in Nacht, and ch[2] in nicht, to which may be added the vowel-consonant *y*.



By most linguists the letter *h* is classed among the guttural consonants, because, etymologically, it is closely related to them; but physiology teaches us that it is nothing else but the unmodified, non-sonant breath, passing out of the glottis and striking against the surface of the pharynx and the outside air. Dr. Brücke, on this account, separates it entirely from the consonants proper, and classes it among the laryngal sounds. The letter *h*, therefore, represents nothing else but the *unmodified breath*.

[Rem.—In addition to the laryngal and guttural sounds described above, Dr. Brücke notices some others which are found in the Oriental and Slavonic languages, but as they are foreign to our subject, I do not deem it necessary to enter into their discussion.]

CHAPTER VI.

ON THE SEMI-VOWELS.

§ 15. The semi-vowels may be divided into two classes, very dissimilar apparently, but which have the leading characteristics of this

species of sounds in common. These are vocality and continuity. They also have no corresponding mutes; wherein they have a marked difference from the sonant fluid consonants, *z*, *v*, &c., which, otherwise, are very much like them.

The first class of the semi-vowels consists of the nasal sounds *m*, *n*, and *ng*; and the second of *l* and the several kinds of *r*.

In the pronunciation of the first class of the semi-vowels, the soft palate is lowered, and the sonant breath, being checked in some one of the closed articulating stations, is discharged through the nose. In the pronunciation of *m*, the labial station is thus closed; in that of *n*, the dental; and in that of *ng* in *thing* or *young*, the guttural. *M*, therefore, is related to the labial station; *n*, to the dental; and *ng* to the guttural. This affinity is manifested in the composition of words. The nasal semi-vowels are called *resonants* by Dr. Brücke, because, in their production, the voice simply resounds in the cavities of the mouth and the nose.

In the pronunciation of *l*, the tip of the tongue closes the dental station, but its posterior portion is depressed, so as to allow the sonant breath to pass out between the jaw-teeth, and along the cheeks. Of the semi-vowel *r* there are three kinds. The first we may call the *dental r*. It is produced by causing the tongue to vibrate against the gums of the upper incisory teeth, while the sonant breath is propelled through the mouth. The second is the *palatal r*. It is formed by drawing the tongue further into the mouth, and so disposing it there against the hard palate that it can scarcely vibrate. By propelling the sonant breath against it with the view of causing it to vibrate, we obtain the English *r* in *arrow*. The orthoëpists call the former the *trilled R*, and the latter the *smooth*; and they recommend that the *r* be trilled when it precedes a vowel, as in *roll*, *crush*, &c.; but that it be made smooth when it follows a vowel, as in *air*, *orb*, &c. In addition to these, there is the *guttural r*, which is made by causing the uvula to vibrate. This *r*, Dr. Brücke says, is the Provençal *r* of the French, which even now is frequently heard in Paris.

CHAPTER VII.

ON THE COMBINATION OF THE CONSONANTS AND SEMI-VOWELS WITH THE VOWELS.

§ 16. The combination of the semi-vowels and those consonants which are formed of sonorous breath, viz., *b*, *d*, *g*, *v*, and *z*, with the

preceding or following vowels, is effected very easily; for, as they are all formed of sonorous breath, no break occurs in passing from one species of sound to another.

The case is different in passing from a hard consonant to a vowel, or *vice versa*. These are no longer homogeneous sounds; for the former are pronounced with mute and the latter with sonorous breath. When the hard consonants are *initial*, the mute breath employed in their formation must all be ejected before the sonorous breath of the vowels can be heard; and, on this account, there is naturally a chasm between the hard consonants and the following vowels. This chasm is filled up by the breathing sound *h*; for the waste breath, ejected after the explosion of the hard consonants, by striking against the surface of the pharynx, on its passage from the glottis, and in coming in contact with the outside air, assumes the form of this sound. This causes the aspiration of the hard consonants which is frequently noticed. In some languages, this aspiration is stronger; in others weaker, according as the pressure of the air from the lungs is more or less intense, or as the flowing out of the mute breath is sooner or later checked in the glottis. The English aspirate their hard consonants strongly, the Germans weakly, which is the reason that when the consonants *p*, *t*, and *k* are pronounced by German organs, they sound more like *b*, *d*, and *g* to an English ear. When the hard consonants are *final*, *i. e.* when they follow the vowels, their respective articulating stations can, indeed, be closed immediately, and the vowel thus be cut short; but the second operation of their articulation, viz., that of opening the station, which, in a great measure, constitutes their acoustical effect, is naturally heard separately from the vowels. When the hard consonants are *medial*, that is, when they are pronounced between two vowels, as in *rapid*, *meeting*, *pica*, the aspirate is almost entirely lost, and the hard consonants on this account are more intimately connected with the vowels in this instance.

Between the fluid consonants *f*, *s*, *th*, and *sh*, which are also formed of mute breath, and the following vowels, there is no chasm; for in their pronunciation the articulating stations are not suddenly burst open, as is done in the formation of the hard consonants, but they remain ajar, and thus all mute breath preceding the vowels, instead of passing out in the form of the breathing sound *h*, as in the hard consonants, is converted into these fluid consonants themselves. When they are medial and final, and are thus preceded by vowels, there is a tendency observed in them to become sonant, as in *his*, *reason*, &c. This tendency will be discussed in the second part.

With regard to the sonant fluid consonants, viz., *v*, *z*, *th*, Mr. Ellis states (*Essentials of Phonetics*), page 11, that, when they are final, we always pass over into their corresponding non-sonant sounds; and that this may be particularly observed in solemn delivery, as in the reading of clergymen, who, instead of *hiz* (his), *have*, say *hiz*, *havf*.

The several combinations of two or three consonants and semi-vowels, either before or after the vowels, will be discussed under their own especial heads. They combine with the vowels in the same way as when these are preceded or followed by single consonants and semi-vowels.

CHAPTER VIII.

ON CONSONANTAL DIPHTHONGS.

§ 17. We shall now investigate the principles by which the consonants combine with each other. Some of these combinations are so intimate that we may call them *consonantal diphthongs*, while in others, which arise from mere juxtaposition of two consonants, they do not combine at all. The former occur in simple words or stems, and the latter are brought about by the composition of two separate words.

In the pronunciation of the mutes or hard and soft consonants, we may distinguish two separate operations, that of closing and of opening the articulating stations. By each of these operations the proper sound of the mutes is produced; and although, for their full formation, both operations must contribute, still in speech they may be separated, and the mutes be pronounced at one time by the closing, and at another by the opening of the articulating stations; for instance in *apt*, *p* is pronounced by closing the labial station, and *t* by opening the dental; so also in *act*, &c. In fact, there are some combinations where the consonants are pronounced in this manner, and others where each consonant requires to be pronounced both by the closing and the opening of the station, as, for instance, *tp*, *tk*, &c. The former are among the *consonantal diphthongs*, and occur in single syllables, while the other can only exist by the composition of two separate words or syllables, as in *postpone*, *pumpkin*, *milkpan*, *kitcat*, *&c.*

Our next object will be to discuss the various kinds of *consonantal*

diphthongs, and to specify those combinations where two consonants combine with each other, and where they refuse doing so.

The *first* kind of consonantal diphthongs is obtained when the hard consonants are followed by the breathing sound *h*. By this means we get what may be called the *hard consonants aspirated*. The pure aspirates, *i. e.* such where the letter *h* is distinctly pronounced, do not occur in the English language, except in compound words, as in *uphold*, *shorthand*, *workhouse*, &c. But, as has been mentioned above, when the hard consonants are initial and final, they always become more or less aspirated. The breathing sound *h* combines so very intimately with the hard consonants, even when joined to them by composition, that their combination can scarcely be regarded as a consonantal diphthong; but with the soft consonants, at least with the English kind, it does not combine at all, because the sound of the voice with which these consonants are pronounced, excludes the mute breathing sound *h*. So if in *abhor*, *madhouse*, or *log-house*, we wish to sound the letters *b*, *d*, or *g* distinctly, we must pronounce these words slowly, and separate their two constituent members. In conversation, we generally obviate this difficulty by pronouncing the letters *b*, *d*, *g* like *p*, *t*, *k*. In combinations of the fluid consonants with *h*, also, the two words by which they are brought into juxtaposition require to be sounded separately, as in *off-hand*, *race-horse*, *flesh-hook*, *heath-hen*, *stave-head*, &c.; for if we endeavor to pronounce them closely together, the letter *h* is absorbed by the preceding fluid consonants.

§ 18. The *second* kind of consonantal diphthongs is produced when the members of the same consonantal series are pronounced consecutively. The hard and soft consonants of the same series cannot be thus combined on account of their sameness, and, also, because the English hard consonants are pronounced with mute, and the English soft consonants with sonorous breath; and it is a matter of impossibility to pronounce consecutively consonants formed of mute and of sonorous breath. In case they do come together by composition, whenever the hard consonant precedes, it is assimilated to the following soft, as in *cupboard*, *clapboard*, *raspberry*, *blackguard*, &c., which are pronounced as if they were spelt *cubboard*, *clabboard*, *rasberry*, *blaggard*; and when the soft consonant precedes, the word is pronounced in two detached syllables, as in *sub-pœna*, *head-tie*, *hand-tree*, *land-tax*, *dog-kennel*; or when they are pronounced hurriedly the preceding soft is assimilated to the succeeding hard consonant. Next to the aspirates the most intimate conjunction between two consonants is obtained when the hard and soft are followed by

their respective fluid consonants, as in *church* and *judge*. The combinations of this kind which occur in the English language are those of the *cerebral t* and *sh* in *church*; of the *cerebral d* and *zh* in *judge*; of the *dental t* and *th* in width (for *d* before the blown or sharp *th* becomes *t*); of the *alveolar t* and *s* in *hits*, which is spelled *z* in German, and the *alveolar d* and *z* in *needs*, which is spelled *z* in Italian. In the German language, moreover, we find *pf* in *Pferd*, and in English by composition in *hopeful*, also *bv* in *obvious*, and in the German, *kχ* or *kch* in *Stückchen*. Among these, *tsh* and *dzh* are found both as initials and finals, as in *church*, *judge*; and as medials, as in *nature*, *soldier*. *dth*, *ts*, and *dz* are only found as finals, as in *width*, *hits*, *needs*, and *bv* and *pf* as medials in *obvious* and *hopeful*. It was mentioned above that the hard consonants in English before a vowel are naturally aspirated, *i. e.*, a portion of the breath which is used in exploding the articulating stations by striking against the surface of the pharynx, assumes the form of the breathing sound *h*. In the above combinations, after the several articulating stations have been exploded, they are left ajar, and thus, instead of the letter *h*, the corresponding fluid consonants of each station are produced. In the case of the soft consonants, also, the sonant breath, ejected after the explosion of the articulating stations, is moulded into their corresponding sonant fluid consonants by leaving the articulating stations ajar. The connection between these hard consonants and their corresponding fluid consonants is, therefore, as intimate as between the hard consonants and the breathing sound *h*; for, in each case, the succeeding consonants are formed of the waste breath used in exploding the several articulating stations. When the fluid consonants precede, the case is different, for there they only combine with the initial element of the hard consonants, which consists in closing the station; and between this (which is entirely inaudible, except when it is preceded by a vowel) and its second element, a small pause intervenes. The combinations of this kind in the English language are *st*, *zd*, *tht*, *thd*. The first of these, viz., *st*, occurs both as an initial, a final, and a medial, as in *still*, *fast*, *mystic*, but the others only as finals, as in *prized*, *betrothed*, *breathed*. The only word where *zd* also occurs as an initial is *sdeath*, which is probably abbreviated from *God's death*. The Germans are very fond of the combination *sht*, both as an initial, a final, and a medial, but the French are so much opposed to having their hard consonants preceded by fluid ones that they frequently cast out *s* before *t*, *e. g.*, *établir* (establish), *étable* (stabulum), *étain* (stannum), *étancher* (stanch), *étoile* (stella),

&c. In compound words we, moreover, find in English *sht* in *wash-tub*, and *fp* in *half-pay*. The only instance in the English language where two fluid consonants of the same consonantal series are pronounced consecutively, is *ths* in *clothes*, &c., and also in *loathsome*.

§ 19. The *third* kind of consonantal diphthongs is produced by pronouncing consecutively consonants pertaining to different articulating stations. As regards the combinations of this kind in general, it must be repeated that it is a matter of impossibility to pronounce consecutively, in one syllable, consonants formed of mute and of sonorous breath. Thus, combinations like *avt*, *abth*, *agt*, *ags*, *apd*, *asd*, *ashd*, *asg*, &c., as has been observed by Dr. Latham in his "Elementary English Grammar," § 44, are incapable of being pronounced, and, in order to be pronounced, one of the sounds must change its character, and so accommodate itself to the other. This is especially illustrated by the contracted preterits and participles, where *d* is pronounced like *t* after consonants formed of mute breath, and like *d*, after consonants formed of sonorous breath and the semivowels, *e. g.* it is pronounced like *t* in *faced*, *reached*, *stuffed*, *laughed*, *triumphed*, *croaked*, *cracked*, *houghed*, *reaped*, *nipped*, *piqued*, *missed*, *wished*, *earthed*, *betrothed*, *fixed*. It is pronounced as *d* in *daubed*, *judged*, *hugged*, *thronged*, *sealed*, *filled*, *aimed*, *crammed*, *pained*, *planned*, *feared*, *marred*, *soothed*, *loved*, *dozed*, *buzzed* (see Goold Brown, "Grammar of English Grammars," page 157, Obs. 6). Still, in compound words, when we pronounce them in detached syllables, it is possible to pronounce hard and soft consonants in succession, *e. g.*, *backbite*, *catgut*, *football*, *fig-tree*, *hogpen*, *handcuff*, *jackdaw*, *lapdog*, *nightgown*, *wood-pile*, &c. But when these words are pronounced hurriedly, the first of these consonants is invariably accommodated to the second. In order to understand the manner in which the hard and also the soft consonants of the different classes combine, we have first minutely to examine again the process of their formation. The breath issuing from the wind-pipe can be checked in the mouth in three different stations. The first stoppage is caused by the middle of the tongue, the second by its tip, and the third by the lips. From the guttural to the dental station, there is an uninterrupted passage, because the stoppage of both is caused by the same member, viz., the tongue; but the labial station is separated from the dental by a sort of chasm. If, now, we take into consideration that two operations contribute to the pronunciation of the hard and soft consonants, viz., those of closing and of opening the articulating stations—which two operations can be separated in speech—

we are enabled to see that the operation of closing may be performed in the guttural station, while that of opening, by suddenly closing the dental station, may be performed there. Thus, that the same amount of breath which is ordinarily used for the pronunciation of a single guttural or dental consonant, may also be used for uttering a guttural and a dental consonant in succession. Hence, both *ct* and *gd* in *act* and *hugged*, are consonantal diphthongs. The case is different in pronouncing a labial after a dental hard or soft consonant. For, between the dental and labial stations, as has been noticed above, there is a sort of a chasm or of a break, preventing our sliding from a dental to a labial hard consonant with the same facility. Thus, these two consonants cannot be pronounced as closely together as a guttural and a dental. In fact, we have to perform both operations of closing and opening the dental station, before we can do the same in the labial. Hence the combinations *tp* and *db* do not occur in single syllables, but are only found in compound words, as in *footpath*, *postpone*, *postpaid*, &c., and in *wordbook*, *cudbear*, *goodby*, &c. Quite the reverse we notice on passing from a labial to a dental, and from a dental to a guttural hard or soft consonant; for we may easily pass from a labial to a dental, but with difficulty from a dental to a guttural consonant. The reason is, because after performing the first operation of closing the labial station, we can instantly close the dental, and thus, when the time of performing the second operation has arrived, instead of opening the former we can open the latter station. By this means we obtain the consonantal diphthongs *pt* and *bd* in *apt* and *daubed*. On the other hand, the very circumstance of the dental and guttural stations being closed by the same member, viz., the tongue, prevents the exterior consonants *t* and *d* from composing consonantal diphthongs with the interior consonants *c* and *g*. These consonants, therefore, are never found consecutively in the same syllables, but occur only in compound words, *e. g.*, in *footcloth*, *greatcoat*, *kitcat*, *nightcap*, and also *headgear*. As regards the combination of labial and guttural, or of guttural and labial hard or soft consonants, it is impossible for them to constitute consonantal diphthongs, for their respective articulating stations are too far apart to allow any sliding from one station to another. Hence, these combinations, also, never occur in single syllables, but only in compound words, viz., *pk* in *pumpkin*, *sheepcot*, &c., *bg* in *sub-governor*, &c.; *kp* in *barkpit*, *milkpan*, *rock-plant*, *stockpurse*, &c.; and *gb* in *bugbear*, *dogbane*, &c. With respect to the use of the consonantal diphthongs *ct*, *gd*, *pt*, and *bd*, in the English language, they are never

found in the beginning of syllables or stems, but always at their end; and in case they do occur as initials, as in the foreign words *bdellium*, *ctenoid*, *ptisan*, their first consonants are always mute.

A very intimate conjunction is established between the hard and soft consonants of one station and the fluid consonants of another; indeed, in several languages separate characters have been invented for the combinations ending in *s*. With the labial fluid as its last letter we obtain the consonantal diphthongs *tf*, *dv*, *kf*, and *gv*. These combinations although they are closely conjoined and are regular consonantal diphthongs, only occur in compositions, *e. g.* in *catfish*, *hand-vice*, *thankful*, *dog-vane*, &c. With the dental fluid are produced *ks* and *ps*; the former is spelt ξ in Greek, and *x* in English, and the latter ψ in Greek; *bz* and *gz* we find in *tribes* and *hogs*, and also in *example*; *pth* in *depth* and *kth* in *buckthorn*; *psh* and *ksh* are found in *eruption*, *action*, &c. *Ks*=*x* is only found in the middle and at the end of words, as in *exile*, *fix*; in the beginning of words *k* is dropped, as in *xanthic*, which is pronounced *zanthic*; *gz* is a medial in *example* and a final in *hogs*; *pth* is always a final, as in *depth*, and *psh* and *ksh* are medials, as in *ruption*, *action*. Combinations of the hard consonants with the guttural fluid are only found in German diminutives, *e. g.* *pχ* or *pch* in *Läppchen*, *tχ* or *tch* in *Gütchen*. As regards the combinations beginning with a fluid and ending in a hard or soft consonant, I have to repeat a statement, viz., that these combinations are by no means as intimate as when the fluid follow the hard or soft consonants; for in the former case the fluid consonants combine with the initial, and in the latter with the final element of the hard or soft consonants. *F* frequently combines in simple words with *t*, as in *aft*, *oft*, *t* being its nearest neighbor; before *k* it is only found in compound words, as in *half-cock*, &c.; *v*, also, only occurs in compound words before *d* or *g*, as in *grave-digger*, *shave-grass*, &c. As the dental hard consonant very readily combines with *p* and *k* as in *apt* and *act*, because the dental station is intermediate between the labial and guttural, so also the dental fluid *s* experiences no difficulty in preceding these sounds; thus we find *sp* in *spell* and *hasp*, and *sk* in *skill* and *brisk*; *shp* and *shk* only occur in compound words, *e. g.* in *wash-pot*, *flesh-color*; and *thp* in *toothpick*, and *thk* in *heathcock*. Fluid consonants of different stations only very seldom precede each other in simple words; the only instances of the kind in the English language are *sf* in *sphere*, *fth* in *fifth*, and when *f* and *v* are followed by *s* in inflectional forms, *e. g.*, *chiefs*, *halves*, *gives*, &c. In com-

pound words we find *fsh* in *chiefship*, *shf* in *gashful*, and *thf* in *truthful*.

§ 20. I now propose to present in a synopsis the results at which we have arrived in the preceding investigation. I shall first collect all combinations of two consonants which exist in the English language, whether they occur in simple or compound words. Those printed in *capitals* are consonantal diphthongs which occur in roots, those in *italics* such as are obtained by inflectional forms or composition, and those in common type such combinations as are brought about by composition, and where the two consonants refuse to combine.

I.

Combinations of the Consonants with H.

a. *Hard consonants combined with h:*

ph (uphold), *th* (shorthand), *kh* (workhouse).

b. *Soft consonants followed by h:*

bh (abhor), dh (wood-house), gh (log-house).

c. *Fluid consonants followed by h:*

fh (offhand), s-h (race-horse), *χh* (German Buch-halter).
vh (stave-head), sh-h (flesh-hook),
th-h (withhold).

II.

Combinations among the Consonants of the same Stations.

a. *Hard and non-sonant fluid consonants:*

PF (Germ. Pferd, Engl. hopeful), *ts* (hits, Germ. Z), *kχ* (Stückchen),
TSH (church),
tth (width).

b. *Soft consonants and sonant fluid consonants:*

bv (obvious), *dz* (heads, needs),
DZH (judge).

c. *Fluid consonants followed by hard and soft consonants:*

fp (half-pay), *ST* (store, fast), *zd* (zdeath, buzzed),
sht (washtub), *thd* (wreathed),
tht (betrothed).

d. *Fluid consonants of the same station following one another:*

ths (cloths, loathsome).

III.

COMBINATIONS AMONG THE CONSONANTS OF DIFFERENT STATIONS.

a. *Combinations of the hard consonants:*

PT (apt), tp (footpath), kp (barkpit),
pk (pumpkin), tk (kitcat), *KT* (act).

b. *Combinations of soft consonants:*

bd (daubed), db (cudbear), gb (bugbear),
bg (sub-governor), dg (head-gear), *gd* (hugged).

c. *Combinations of hard and fluid consonants:*

ps (mishaps), *tf* (catfish), *KS* (axe, bricks),
SP (spear, hasp), *FT* (aft), *SK* (skill, brisk),
pth (depth), *tχ* (Germ. Gütchen), *kf* (bookful),
psh (ruption), fk (half-cock),
pχ (Germ. Läppchen), *kth* (buckthorn).

d. *Combinations of soft and fluid consonants:*

bz (tribes, daubs), dv (handvice), *GZ* (example, eggs),
zb (rose-bud), vd (grave-digger), zg (rose-gall),
bχ (Germ. Täubchen), dχ (Germ. Brödchen), gv (dog-vane),
vg (shave-grass).

e. *Combinations of the different fluid consonants:*

fs (life-string), *sf* (blissful, sphere),
fsh (chiefship), *sχ* (Germ. Häuschen),
fth (twelfth), shf (gashful),
fχ (Germ. Häufchen), shχ (Germ. Räuschchen),
vs (lives, gives), thf (truthful).

I shall now collect those consonantal diphthongs which are *initial:*

TSH (church), *ST* (still), *SK* (skill),
DZH (judge), *SP* (spear), *SF* (sphere).

Those which are *medial:*

p-h (uphold),	kp (back-piece),	*ks* (exile),	*st* (plastic),
t-h (shorthand),	*kt* (doctor),	*ksh* (action),	*sk* (basket),
kh (workhouse),	*bd* (subdue),	*kth* (buckthorn),	thp (toothpick),
bh (abhor),	bg (sub-governor),	*tth* (cutthroat),	thk (heathcock),
dh (woodhouse),	db (cudbear),	*bv* (obvious),	shp (flesh-pot),
gh (log-house),	dg (head-gear),	*bz* (absent),	*sht* (washtub),
fh (offhand),	gb (bugbear),	*dv* (handvice),	shk (flesh-color),
vh (stave-head),	*gd* (dogday),	*dz* (gladsome),	vd (gravedigger),
th-h (withhold),	*pf* (topful),	*dzh* (Bridget),	vg (shave-grass),
s-h (race-horse),	*ps* (tipsy),	*gv* (dog-vane),	zb (rose-bud),
sh-h (flesh-hook),	*psh* (ruption),	*gz* (example),	fs (beef-soup),
pt (baptist),	*tf* (catfish),	fp (half-pay),	fsh (chiefship),

pk (napkin), *ts* (lightsome), *ft* (lofty), ths (loathsome),
tp (footpath), *tsh* (hatchet), fk (half-cock), sf (blissful),
tk (kitcat), *kf* (bookful), *sp* (jasper), shf (gashful),
thf (truthful).

Those which are *final:*

tth (width), *DZH* (judge), *zd* (buzzed, prized),
dz (heads), *ST* (fast), *ths* (cloths),
ts (hits), *tht* (betrothed), *PT* (apt),
TSH (church), *thd* (breathed), *KT* (act),
bd (daubed), *gd* (hugged),
ps (mishaps), *SP* (hasp),
pth (depth), *FT* (aft),
KS (axe), *SK* (brisk),
bz (tribes), *GS* (eggs),
fth (twelfth), *vs* (lives).

CHAPTER IX.

ON THE SEMI-VOWEL DIPHTHONGS.

§ 21. The great difference between the semi-vowels and the consonants becomes apparent in the combinations which they form both among themselves and with the consonants. For there the semi-vowels display a much greater freedom than the consonants. Still there is a distinction in this respect even among the semi-vowels themselves, *r* and *l* being more independent than *m*, *n*, and *ng*; for these latter are more or less limited by their affinity to some one of the articulating stations of the consonants. As a general thing, *r* and *l* combine as readily with the labial as with the dental and guttural consonants; and while the blown or non-sonant fluid consonants only combine with the hard, and the sonant fluid consonants with the soft consonants, *all* the semi-vowels combine as well with the former as with the latter. The only difference is this, that when the semi-vowels are preceded by a hard consonant, the aspirate by which these are usually followed renders the beginning of the semi-vowels mute, while those which are preceded by a soft consonant are sonant from their very beginning. There is another peculiarity distinguishing the semi-vowel combinations or diphthongs from those of the consonants, viz., that whatever may be the combination, the semi-vowel is

always next to the vowel; thus, when the semi-vowel diphthong is in the beginning of a word, the semi-vowel is always in the second place, *e. g.*, *prow*, *grow*, *plough*, *true*, &c.; and when it is at the end of a word, the semi-vowel is always in the first place, *e. g.*, *harp*, *heart*, *lark*, *salt*, *hand*, &c. These combinations, therefore, clearly indicate that the semi-vowels are an intermediate species of sound between the vowels and consonants.

§ 22. Of the two sounds *r* and *l*, again, the former seems to take the precedence, inasmuch as we find combinations of *rl*, *e. g*, *snarl*, *girl*, *hurl*, &c., but never any of *lr*, except in compositions, *e. g.*, *hill-road*; and while combinations of *r* and the nasals, *e. g.*, *arm*, *barn*, &c., are all stable, *l* becomes quiescent before *m* and *n*, when preceded by *a* and *o*, *e. g.*, *calm*, *balm*, *holm*, *Holmes*, *auln*; still we find *elm*, *film*, *stulm*. In *kiln*, it is the *n*, which is rendered quiescent.

Whenever *r* and *l* are preceded by the nasals, the affinity of the latter for their respective consonants is developed. Thus, *tumle* (Germ. *taumeln*) is changed into *tumble*, *numer* (Lat. *numerus*) into *number* (French *nombre*), *ciner* (Lat. *cinerem*) into *cinder* (French *cendre*), *thunner* (Germ. *Donner*) into *thunder*, *spinnel* (to spin) into *spindle*. After *ng* in *young*, another *g* is inserted, as in *younger*, *hungry*, *wrangle*. This second *g* is plainly noticed in the pronunciation, but it is not expressed in spelling. This peculiarity of inserting the mutes is derived to the English from the French, where we find *viendrai*, *nombre épingle* (Lat. *spinula*); while in German we find *Donner*, *Numer*, *hungrig* (pronounce *hung-rig*), *jünger* (pronounce *jüng-er*). A similar tendency of inserting the mutes is noticed in Latin and Greek, especially in the latter, where we find *μέμβλωκα*, *ἀμβλύνω* for *ἀμαλύνω*, *ἄμβροτος*, *ἀνδρός* instead of *ἀνέρος*, &c. (See *R. F. Weymouth on the liquids, in relation to certain mutes*, in Transactions of the Philological Society, London, 1856.)

The combination of two nasal semi-vowels is incapable of being pronounced except when it is medial, as in *autumnal*. When it is final, one of its constituent members is suppressed, as in *autumn*, *condemn*, *limn*, where the letter *n* is not pronounced. In French it is just the opposite, and the letter *m* is made quiescent, as in *condamner*, *automne*, &c.

§ 23. Concerning the combination of the semi-vowels with the consonants, it was noticed above that in the beginning of words the semi-vowels always follow, as in *prow*, *clown*, and at the end of words they always precede, as in *bark*, *pelt*, &c. We, moreover, noticed

that while the non-sonant fluid consonants only combine with the hard, and the sonant fluid consonants with the soft, the semi-vowels combine as readily with the former as with the latter, with this difference only, that when they are preceded by a hard consonant, the aspirate which usually follows these sounds renders the first part of the semi-vowels mute, while they are sonant from the very first, when they are preceded by a soft consonant. Compare *plough* and *blow*, *true* and *drew*, *crow* and *grow*. We thus obtain with the semi-vowel *r*, in the beginning of words, the combinations *pr* and *br* in *prow* and *brow*, *tr* and *dr* in *true* and *drew*, *cr* and *gr* in *crow* and *grow*. At the end of words, we find *rp* in *harp*, and *rb* in *barb*, and *herb*, *rt* in *part*, and *rd* in *herd*, *rk* in *park*, and *rg* in *berg*. With the semi-vowel *l*, we find in the beginning of words the following combinations, viz., *pl* in *plough* and *bl* in *blow* (*tl* and *dl* in the English and the European languages in general only occur in compositions, as in *cutlass*, and as medials, in *Dudley*, *motley*, but they are of favorite occurrence in the old Mexican language), *kl* in *clown*, *gl* in *glow*. At the end of words we find *lp* in *help* and *lb* in *bulb*, *lt* in *salt* and *ld* in *yield* (in *could*, *should*, *would*, *l* is quiescent). There seems to be a disaffection in the English language between the guttural hard and soft consonants and *l;* inasmuch as *l* before *k* when preceded by *a* and *o* is invariably rendered quiescent, as in *stalk*, *chalk*, *caulk*, and *folk*, *Polk*. It is, however, pronounced in *yolk*, and after *e*, *i*, *u*, as in *elk*, *milk*, *bulk*. When *l* is followed by *g*, this is either converted into a sibilant, as in *bulge*, *bilge*, or else it is cast out, as in *follow* (Germ. *folgen*), *gallows* (Germ. *Galgen*), *bellows* (Germ. *Balg*), *billow* (Dut. *bolge*). The same thing we notice in the combinations of *r* with *g*, where, with the exception of *berg* in *ice-bery*, *g* is either made soft, as in *barge*, *merge*, *spurge*, or else it is ejected, as in *morrow* (Germ. *Morgen*), *borrow* (Germ. *borgen*), *sorrow* (Germ. *Sorge*). Still, we find the combinations of *lg* and *rg* as medials and in compositions, as in *fulgor*, *toll-gate*, *bargain*, *cargo*.

With regard to the combinations of the nasal semi-vowels and the mutes, the English language is opposed to having any nasal preceded by a mute, except in the middle of words, where we find *indignant*, *figment*, *titmouse*, &c. Thus, in *tmesis*, *pneumatics*, *know*, *gnaw*, the mutes are invariably rendered quiescent. At the end of words, the nasals manifest a decided affinity for their respective mutes. Thus we find *m* followed by *p* and *b*, as in *lamp* and *slumber;* *n* by *t* and *d*, as in *flint* and *sand;* *ng* or the guttural *n* by *k* and *g*, as in *shank* and *finger*. When *mb* and *ng* are final, *b* and *g* are always

quiescent, as in *dumb* and *young*; but in the middle of words, they are distinctly sounded, as in *slumber* and *finger*. The relation between the three nasals is more intimate than between any other three letters; indeed, they seem to be mere shades of one general nasal sound, each peculiar shade being determined by its following mute. This we see especially illustrated in the Greek compounds with σὺν and ἐν. In this language, the guttural *n*, for which we have no particular sign in English, is represented by γ. Thus, before the labials, we find συμ, as in συμπέμπω and συμβαίνω, before the dentals συν, as in συντείνω and συνδέω, and before the gutturals συγ, as in συγχαλέω and συγγίγνομαι. The tendency of changing *m* into *n* before dentals is so strong that in order to preserve *m* before *t*, we must fortify it by the insertion of *p*, as in *contempt*, *attempt*; hence, also, the double forms *tempto* and *tento* in Latin. *M* we find preserved before *d*, by the insertion of β in the Greek *Lambda*. Neither *n* or *ng* are ever found before the labials, except in compound words, as in *brain-pan*, *long-boat*, &c.; nor do we find *m* and the dental *n* before gutturals except in like cases, as in *gimcrack*, *mankind*.

The semi-vowels combine very readily with the fluid consonants, both at the beginning and at the end of syllables. With *r*, in the beginning of words, we find *fr* in *free*, *thr* in three, *shr* in *shrine* (*sr* is only found in compositions, as in *moss-rose*); at the end of words, we find *rf* in *dwarf*, *rv* in *starve*, *rth* in *north*, *rs* in *horse*, *rsh* in *harsh*, *rχ* in Germ. *durch*. With *l*, in the beginning of words, are found *fl* in *flow*, *sl* in *slow*, *shl* in German, *schlau*, and in the compound *rashly*, *thl* in *faithless*; at the end of words, *lf* in *self* (when preceded by *a*, *l* before *f* is quiescent, *e. g. calf*, *half*), *lv* in *delve*, *ls* in *pulse*, *lth* in *health*, *lsh* in *Welsh*, *lχ* in Germ. *welch*. With *m*, in the beginning of words, we find *sm* in *smart*, *shm* in Germ. *schmieren*, and in the compound *hash-meat* (*fm* and *thm* are only found in compositions, *e. g. deaf-mute*, *Northmen*); at the end of words, *mf* in *nymph* (Germ. *dumpf*, &c., where *p* is interposed between *m* and *f*), *mth* in *warmth*, *ms* in plurals of nouns ending in *m*, *e. g. hams*, *gems*, *msh* in *redemption*, and in compounds, as *steam-ship*, and *mχ* in German compounds, *e. g. Blümchen*. With *n*, in the beginning of words, we find *sn* in *snow*, *shn* in Germ. *Schnee* (*fn* and *thn* are only found in compounds, as in *stiffness*, *uncouthness*); at the end of words, *nf* in Germ. *fünf*, and English compounds, *e. g. manful*, *nth* in *month*, *ns* in *chance*, *pens*, &c.; *nsh* in *mansion*, and in *punch*, where there seems to be a slight touch of the *t* after *n*, *nzh* in *sineg*, *nχ* in Germ. *Mönch*. Combinations of the guttural *n* and the fluid

consonants are only found at the end of syllables; *ngf* in Germ *Jungfer*, and English compounds, *e. g. wing-footed*, *ngth* in *length*, *ngs* in *stings*; *ngsh* is found in compounds, *e. g. slung-shot*, and *ngχ* in German compounds, *e. g. Dingchen*.

§ 24. Thus far those combinations of the semi-vowels and consonants only have been investigated, where the semi-vowels are nearest to the vowels. I shall now examine the phenomena exhibited by the semi-vowels, when they appear in an inverse position. In the beginning of words, there is no instance whatever of a semi-vowel preceding a consonant, but at the end of syllables, we sometimes find a semi-vowel succeeding a consonant, as in *chasm*, *spasm*, &c. These combinations I intend now to consider. It has been stated above, in treating of the unmodified vowel, that it is the element animating the semi-vowels, and some instances have been adduced, viz., *mitre*, *centre*, *theatre*, &c., where the animating principle of the semi-vowel has been mistaken for a separate vowel; for in these words it is generally supposed that the final *e* is pronounced before the *r*, and in order to make the spelling and the pronunciation agree, it has been proposed to spell them *miter*, *center*, *theater*, as has been done in several other instances. In *button*, *spoken*, *label*, *bosom*, also, it is usually supposed that we pronounce a vowel between the last two consonants, while in reality, the vowel we hear is nothing else but the inherent sound of the semi-vowels themselves. Nevertheless, all these words are regarded as dissyllables, although their second syllables, as we have just seen, are formed merely by appending a semi-vowel to the first syllables. Thus the semi-vowels in these words are not only in the place of vowels, but even of entire syllables: hence, the apropriateness of calling them semi-vowels.

This capacity of serving as vowels, or rather as entire syllables, is always developed, in the English language, in the semi-vowels, when they are not immediately connected with a vowel, as in *spasm*, *chasm*, &c., where a consonant intervenes between the vowels and semi-vowels, and where the letter *m* is pronounced in the same way, as the syllable *om* in *blossom*, *bosom*. The reason of this is, that the semi-vowels partake both of the nature of the vowels and of the consonants; and, as has been mentioned above, are an intermediate species of sounds between the consonants and the vowels. When they are brought into juxtaposition with the vowels, their own vowel-nature is obscured, and they serve in the capacity of consonants, but when they are separated from the vowels, and surrounded by consonants only, as in *spasm*, *lable*, *centre*, &c., their vowel-nature becomes

clearly manifest, and relieves them from the surrounding consonants. In the former case, they enter into diphthongal relations with the consonants, and act as mediums between the consonants and the vowels, but in the latter case they refuse doing so. In the French language it is different. There the semi-vowels, when they close a word after a consonant, are pronounced with mute breath, as in *maître*, *peuple*, *titre*, and these words are thus essentially monosyllables, although the semblance of dissyllables is impressed upon them by the final mute *e* with which they are spelled. The mode of spelling these final semi-vowels is various in English. When the words end in *m*, and are preceded by *s*, the semi-vowel is simply added to *s*, as in *chasm*, *spasm*, *schism*, &c., or else it is preceded by *o*, as in *bosom*; when *r* or *l* are the final semi-vowels, they are either followed by a mute *e*, as in *mitre*, *acre*, *bible*, *bridle*, *eagle*, or else they are preceded by *a*, *e*, or *o*, as in *bridal*, *model*, *gambol*, *sugar*, *wafer*; *n* is usually preceded by *o* or *e*, as in *nation*, *mutton*, *maiden*.

§ 25. After having fully discussed the semi-vowel diphthongs as initials and finals, we have now to consider them as medials. In the beginning of words, when semi-vowels combine with consonants, the semi-vowels are always in the second, and, at the end of words, in the first place, but in the middle of words both combinations occur. Still, we notice a remarkable distinction in their use; when an initial combination occurs as a medial, there is a decided break between the preceding consonant and the following semi-vowel, as in *cit-ron*, *fab-ric*, *ug-ly*, *at-las*, *dog-ma*, &c.; but when a final combination is found medial, their diphthongal relation continues unimpaired, as in *certain*, *harvest*, *murder*, *furbish*, *vulgar*, *pilfer*, *halter*, *anthem*, &c.

§ 26. I shall now present the reader with a synopsis of the various combinations which the semi-vowels undergo, both among themselves and with the consonants; those which are printed in capitals are regular diphthongs and occur in single syllables, while those which are printed in common type, denote that they do not combine, and are only found in compositions, and those in italics that one of the two members of the combinations is quiescent.

I.

COMBINATIONS OF THE SEMI-VOWELS AMONG THEMSELVES.

a. *The semi-vowels R and L:*

RL (snarl), lr (hill-road).

b. *The semi-vowels R and L, and the Nasals:*

RM (arm), *RN* (barn),

LM (elm, film, stulm), *lm* (calm, holm),
ln (auln, kiln).

c. *The Nasals preceding the Semi-vowels R and L:*

mr=mbr (number), nr=ndr (thunder), ngr=ng-gr (finger),
ml=mbl (tumble), nl=ndl (spindle), ngl=ng-gl (mingle).

d. *Two Nasals combined:*

mn (autumnal), *mn* (limn).

II.

Combinations of the Semi-vowels with the Mutes.

a. *The Semi-vowel R and the Mutes:*

PR (prow), *BR* (brow), *RP* (harp), *RB* (herb),
TR (true), *DR* (drew), *RT* (part), *RD* (hard),
KR (crow), *GR* (grow), *RK* (park), *RG* (berg).

b. *The Semi-vowel L and the Mutes:*

PL (plough), dl (Dudley), *LK* (elk, milk, yolk, bulk),
tl (cutlass), *GL* (glow), *lk* (stalk, folks), *LG* (fulgor=bilge).
KL (clown), *LP* (help), *LB* (bulb),
BL (blow), *LT* (salt), *LD* (yield),

c. *The Semi-vowel M and the Mutes:*

pm (shipmate), bm (cabman), *MP* (lamp),
MB (slumber), *mb* (dumb).
tm (tmesis), tm (titmouse), dm (headman),
MT=MPT (contempt), md=mbd (lambda).
km (acme), gm (figment), mk (gimcrack),
mg (steam-gun).

d. *The Semi-vowel N and the Mutes:*

pn (pneumatics), pn (cheapness), bn (subnect),
np (tan-pit), nb (sunburnt).
tn (stoutness), dn (goodness), *NT* (flint), *ND* (sand),
kn (blackness), *kn* (know), *gn* (gnaw), gn (indignant),
nk (mankind), ng (sun-gilt).

e. *The Semi-vowel Ng and the Mutes:*

ngp (spring-pin), ngb (dung-beetle), ngt (spring-tide),
ngd (ring-dove), *NgK* (drink), *NgG* (younger).

III.

Combinations of the Semi-vowels with the Fluid Consonants.

a. *The Semi-vowel R and the Fluid Consonants:*

FR (free), *ThR* (three), sr (moss-rose), *ShR* (shrine),

RF (dwarf), *RV* (starve), *RTh* (north), *RS* (horse), *RSh* (harsh), *RX* (Germ. durch).

b. *The Semi-vowel L and the Fluid Consonants:*

FL (flow), *SL* (slow), shl (rashly, Germ. ſchlau), thl (faithless). *LF* (self), *lf* (calf), *LV* (delve), *LTh* (health), *LS* (pulse), *LSh* (Welsh), *LX* (Germ. welch).

c. *The Semi-vowel M and the Fluid Consonants:*

fm (deafmute), thm (Northmen), *SM* (smart), shm (hash-meat; Germ. ſchmieren, Fr. chemin). *MF* (nymph, Germ. dumpf), *MTh* (warmth), *MS* (gems), *MSh* (redemption), *mχ* (Germ. Blümchen).

d. *The Semi-vowel N and the Fluid Consonants:*

fn (stiffness), thn (uncouthness), *SN* (snow), shn (cash-note, Germ. Schnee).
nf (manful), Germ. (Hanf), *NTh* (month), *NS* (chance, sons), *NSh* (mansion, punch), *NZh* (singe), nχ (Germ. Mönch).

e. *The Semi-vowel Ng and the Fluid Consonants:*

ngf (wing-footed, Germ. Jungfer), *NgTh* (length), *NgZ* (stings), ngsh (slung-shot), ngχ (Germ. Dingchen).

IV.

Spurious Semi-vowel Diphthongs.

a. *Combinations ending in R:*

br (fibre), tr (mitre), pr (acre), gr (ogre),

b. *Combinations ending in L:*

pl (staple), bl (noble), fl (rifle), tl (title), dl (idle), kl (crookle), gl (ogle).

c. *Combinations ending in M:*

sm (chasm).

We will collect now those combinations which are initial, final, and medial.

1. *Initial Semi-vowel Diphthongs:*

pr (prow),	dr (drew),	gr (grow),	sl (slow),
br (brow),	thr (three),	pl (plough),	kl (clown),
fr (free),	shr (shrine),	bl (blow),	gl (glow),
tr (true),	kr (crow),	fl (flow),	sn (snow).

2. *Final Semi-vowel Diphthongs:*

a. In simple words or stems:

rl (snarl),	rs (horse),	lt (salt),	nt (flint),
rm (arm),	rsh (harsh),	ld (hold),	nd (sand),

rn (barn), rk (park), lth (health), nth (month),
rp (harp), rg (berg), ls (pulse), ns (chance),
rb (herb), lm (elm), lsh (Welsh), nsh (punch),
rf (dwarf), ln (kiln), lk (elk), nzh (singe),
rv (starve), lp (help), mp (lamp), ngk (drink),
rt (part), lb (bulb), mf (nymph), ngth (length).
rd (herd), lf (self), mpt (tempt),
rth (north), lve (delve), mth (warmth),

b. Combinations obtained by inflection:

ms (hams), ns (sons), ngs (stings).

3. *Medial Semi-vowel Diphthongs:*

a. Initial combinations:

pr (leprous), pl (poplar), (triplet), pm (shipmate), pn (cheapness),
br (fabric), bl (public), bm (cabman), bn (subnect),
fr (life-rent), fl (chiefly), fm (deafmute), fn (stiffness),
tr (citron), tl (motley), tm (nutmeg), tn (stoutness),
dr (midriff), dl (Dudley), dm (headman), dn (kidney),
thr (brethren), thl (toothless), thm (Northmen), thn (ethnic),
sr (moss-rose), sl (gosling), sm (dismal), sn (visney),
cr (backroom), shl (rashly), shm (hash-meat), shn (cash-note),
gr (doggrel), kl (blackleg), km (acme), kn (cockney),
gl (ugly), gm (figment), gn (stagnant).

b. Final combinations:

rl (barley), rv (marvel), ld (shoulder), nv (anvil),
rm (marmot), rt (garter), ls (palsy), np (tan-pit),
rn (furnish), rd (hardock), lk (malkin), nb (sunburnt),
lm (filmy), rth (burthen), lg (fulgor), nf (manful),
ln (alnage), rs (dorsal), mp (damper), nt (apprentice),
mr (emrod), rsh (marshal), mb (ember), nd (tendon),
ml (hemlock), rk (market), mf (roomful), nth (anthem),
nr (Henry), rg (organ), mt (tempter), ns (census),
nl (dunlin), lp (vulpine), md (lambda), nz (frenzy),
ngl (English), lb (album), ms (crimson), nsh (mansion),
rp (carpet), lf (elfin), msh (redemption), nk (mankind),
rb (orbit), lv (culvert), mk (gimcrack), ng (sun-gilt),
rf (orphan), lt (sultan), mg (steam-gun), ngp(spring-pin),
ngb (dung-beetle), ngd (ring-dove), ng-k (clinker),
ngf (wing-footed), ngs (longsome), ng-g (finger).
ngt (spring-tide), gnsh (slung-shot),

In the following semi-vowel combinations, one of their two members is quiescent:

a. The letter *n* in *mn, ln, e. g. condemn, kiln.*

b. The letter *l* in *lm, ln, lk, lf,* when they are preceded by *a,* and to some extent by *o, e. g. calm, holm, auln, stalk, folks, calf,* and in *ld,* when preceded by *ou* in *could,* &c.

c. The mutes preceding the nasals in *kn, gn, pn, tm, e. g. know, gnaw, pneumatics, tmesis.*

d. The letter *b* in *mb, e. g. dumb.*

CHAPTER X.

COMBINATIONS OF THE VOWEL-CONSONANTS Y AND W WITH THE CONSONANTS AND SEMI-VOWELS.

§ 27. The vowel-consonants *w* and *y,* as has been demonstrated above (§ 7), are consonants generated from the vowel-sounds *oo* or *u* in *flute,* and *ee* or *i* in *machine,* by increasing, on the one hand, the contraction of the lips, and on the other, the pressure of the middle of the tongue against the hard palate. *W* is the consonantal *u, y* the consonantal *i.* Both are developed from their respective vowels by gradually emphasizing their pronunciation. Thus, if we pronounce *ee* with a low voice, and gradually raise it, we arrive at the sound of *y* in *year;* so also, by gradually raising the voice in the pronunciation of *oo,* we pass over into the sound of *w* in *we.* The reason of this is, because the degree of firmness with which the articulating stations are either partially or entirely closed in the pronunciation of the consonants, corresponds entirely with the greater or lesser pressure of the air, brought to bear against them; thus, when we speak loudly, the articulating stations are closed firmly, and in the degree in which our speech diminishes in loudness, the articulating stations are closed less firmly. The same thing we notice in the pronunciation of *ee* and *oo.* In the pronunciation of the former, the middle portion of the tongue almost reaches the palate; if, now, we suddenly increase the pressure of the air from the lungs, in order to preserve the character of the vowel *ee,* we are compelled to increase the pressure of the tongue against the palate; hence, the transition of *ee* or *i* in *machine* into *y.* The same applies to the pronunciation of *oo* or *u* in *flute.* I hold, then, as a law, that *w* may be produced by an emphasizing of *u,* and *y* by that of *i.* Still, this

is not the only mode by which *w* and *y* may be generated from the vowels *oo* and *ee*. If we pronounce *oo* quickly before *ay*, as for instance, in the geographical name *Douay'*, this sounds just as if it was spelled *Dway'*; so *too-ang*, when pronounced quickly, sounds like *twang*, *suavity* like *swavity*, *persuade* like *perswade*, *guava* like *gwava*, *language* like *langwage*. So also by sounding *i* in *machine* quickly before any other vowel, as in *siesta*, *Diego*, *Tierra*, *Sierra*, *piano*, it passes over into the sound of *y* in *year*; and *iest* in *siesta* sounds like *yest* in *yesterday*, *ierr* in *Sierra* and *Tierra* as if it was spelt *yerr*, and *iano* in *piano*, as if it was spelt *yan-o*. *W* and *Y*, however, are not only produced by the hardening of vowels, but also by the softening of consonants, so Ags. *geard* becomes *yard*, Ags. *gearn*, yarn; *geonan*, yawn; *gealpan*, yelp; *gestrandaeg*, yesterday; *daeg*, day; *saegan*, say; Germ. *schlagen*, slay; and also Ags. *gnagan*, gnaw; *maga*, maw; *bugen*, bow; Germ. *sægen*, saw.

§ 28. The vowel-consonants *w* and *y* by the very nature of their formation, can only be sounded after consonants or semi-vowels, and never before them; thus, *w* in *wring*, *wreck*, *write*, &c., is quiescent, and also before *h*, as in *who*, *whole*, *whoop*. The German words, *Wrack*, *Wrange*, *wricken*, are pronounced *vrack*, *vrang-e*, *vricken*; so the Russian name *Wladimir* is pronounced *Vladimir*, and the Swedish names, *Wrangel*, *Wrede*, *Vrang-el Vred-e*. *Y* before consonants becomes *i*, as in *ycleped*, *yclad*, *yttrium*, and also in the middle and at the end of words, as in *chyst*, *tyrant*, *symbol*, *sylvan*, *try*, *why*, &c.

With preceding consonants, *w* enters into the following combinations: *hw* in *white*, *whet*, *while*, where the order of the consonants is inverted in spelling; in the Anglo-Saxon, these words were spelled *hwit*, *hwettan*, *hwil*. *Pw* and *bw* do not occur in the language; they are of too difficult pronunciation. *Tw* is found in *twang*, *dw* in *dwarf*, *kw* in *quart*, *question*, *gw* in *guava*, *language*. The combination *fw* is out of question, because these two sounds are too nearly related. *Thw* we find in *thwart*, *sw* in *sweet*. With the semi-vowels, *w* refuses to enter into any combinations whatever.

§ 29. The combinations of the vowel-consonant *y*, and the consonants and semi-vowels, are a little difficult to trace in the English language, as this sound is represented by *y* only in the beginning of words, as in *yarn*, *yawn*, &c., and in the middle of words, is either not expressed at all, as in the long sound of *u*, or else is given by the signs of the vowels *i* and *e*. Again, some orthoëpists think they can distinguish *y* where others only see *i* in *in*; as for instance, in the

long sound of *u*, which *Walker* (171) says is exactly the pronoun *you*, while *Latham* holds (Elementary English Grammar, § 36), that it consists of the sound of *i* in *pit*, followed by that of *w* in *will*, rapidly pronounced. The fact is, the precise line where *i* ceases and *y* begins, is sometimes very difficult to say, and the only rule that can be laid down for the detection of the latter is, that when *i* or *e* are alone by themselves, as in *sit*, *be*, *wind*, they are always vowels, but when they precede other vowels, as in *radiant*, *opinion*, *copious*, *aqueous*, *ruffian*, &c., they either entirely pass over into *y*, or else have a strong tendency in that direction. When these last combinations are spoken softly and slowly, we recognize *i* in *pit*, but when their pronunciation is emphasized, and they are spoken hurriedly, we hear the semi-vowel *y*.

From these remarks it follows that it is impossible to establish satisfactorily all the combinations between the consonants and the semivowels and *y*; inasmuch as some combinations which are admitted by the one are denied by the other. The only cases where all orthoëpists agree to give to *i* the sound of *y*, are after *t* in *Christian*, after *d* in *Indian*, after *l* in *bullion*, *stallion*, and after *n* in *pinion*, *onion*. Some recognize it after *r* in *clarion*, and *Knowles* admits it after *v* in *niveous*. Still, I venture to suppose that an unprejudiced ear will clearly distinguish *y* also in the following words, viz., *pure*, *tube*, *cue*, *hue*, *dew*, *bugle*, *few*, *Jew*.

§ 30. The vowel-consonant *w* in some words exercises an influence upon the following vowel, as in *war*, *what*, *wolf*, *woman*, where it communicates to *a* the sound of *a*°, and to *o* that of *oo*, but *y* influences the preceding consonants, which it has a tendency to break up and to convert into sibilants. This influence of the vowel-consonant *y* upon the preceding consonants, which is one of the most remarkable linguistic phenomena, has been discussed at full length in the work of my father and myself on "Latin Pronunciation,"* in treating on the pronunciation of the Greek zeta. The leading results which have there been obtained, I shall here subjoin, but for further particulars I refer the reader to the other work.

The guttural and dental mutes which originally were pronounced firmly and distinctly, in many languages, in the course of time became weakened, and were pronounced less distinctly, and in order to strengthen them in their weakened condition, either the following *i* and *e*, when preceding other vowels, were hardened into *y*, or else

* Latin Pronunciation and the Latin Alphabet, by Dr. Leonard Tafel and Prof. R. L. Tafel. Mason Brothers, New York, 1860.

this letter was simply inserted into stems. This insertion of *y* after the mutes we notice in the Icelandic and the Danish languages. The first effect of this letter *y* upon the preceding *k* was to change it into *t*. This effect of *y* is exercised in the Swedish and the Magyar languages; it is also noticed in the Latin, where it gave rise to the spelling *nuncius* and *nuntius*, *concio* and *contio*. The next step was for *y* to be changed into the sibilants *sh* or *s*; hence the combinations *tsh* and *ts*. And the last step for the sibilants *sh* and *s* to cast off the preceding *t*. In a similar way *t* was changed into *tsh* and *ts*, and finally into *sh* and *s*; and *g* and *d* into *dzh* and *dz*; and, finally, into *zh* and *z*. The assibilation of *c* or *k* and *g*, at first, only assailed these consonants, when *i* and *e* were followed by another vowel, but in the course of time it extended to all cases where *k* or *c* and *g* were succeeded by a single *i* or *e*.

With regard to the sibilation of *y* after the mutes, I would here add, that this is effected by the aspirate which succeeds the hard consonants in some languages (see above, chap. vii). For when *y* is pronounced hurriedly after the dental and guttural hard consonants, its vowel-element is extinguished by the aspirate (h) following them, and nothing but its palatal breathing remains (see Dr. Brücke, page 74). From this palatal breathing, which is produced by the pressure of the middle of the tongue against the hard palate, where the guttural station verges towards the dental, a very small depression of the middle of the tongue is all that is required in order to produce the sibilant *sh*, which is retained in some languages, and in others was rapidly reduced into *s*. The fact that the sibilation of *y* was caused by the aspirate of the preceding mutes, is proved by the history of language, which teaches that the process of assibilation first commenced among the hard consonants, and after it had long been established among them it finally extended to the soft.

§ 31. In the English language, we notice the process of assibilation in all its stages of development. Thus we find *t* followed by *y* in *courteous*, *bestial*. We find *y* assibilated in *nature*, *virtue*, and the preceding *t* cast out in *nation*, *martial*. In the other languages it is different; thus, in the Italian, only the combinations *ts* and *dz*=*z*, *tsh*=*ci*, and *dzh*=*gi* exist, and in the French *zh*=*j*, *ge*, *gi* in *jardin*, *gorge*, *gite*, and *s*=*ti*, *ce*, *ci* in *nation*, *celle*, *cire*. The reason why in English we find these manifold forms of assibilation is this, because some Latin words were imported into England by the Normans in the finished state of French assibilation; hence, *c* before *e* and *i* is pronounced like *s* as in French, while in other Latin words the as-

sibilation commenced on English ground, thus French *nature* pronounced with hard *t*, in England, first became *nā-tyur*, and finally *nā-tshŭr*, and *soldier* was first changed into *soldyer* and finally into *soldzher*.

§ 32. The process of assibilation was not entirely foreign to the Anglo-Saxon before the Norman conquest. Either immediately before, or very soon after this event, we find the Saxon words *ceaf*, *cealk*, *ceat*, *cearl*, *ceosan*, *ciern*, *cyst*, *cyrice*, *cyn*, *cicen*, *cidan*, *cild* (it must be noticed that the Anglo-Saxon *c* was pronounced like *k*) assibilated into *chaff*, *chalk*, *cheat*, *churl*, *choose*, *churn*, *chest*, *church*, *chinn*, *chicken*, *chide*, *child*. This assibilation took place in the usual manner. *E* in the diphthongs *ea* and *eo* was hardened into *y* after the guttural *c* or *k*. *Y* first weakened *k* into *t*, and finally became itself assibilated into *sh* (of this we have an instance in the forms *feccan* and *fetian* to *fetch*); hence the sound *tsh* in *chaff*, &c. This sibilation of *k* before *ea* and *eo* afterwards extended to those cases where it was followed by *y* and *i*, and subsequently also reduced the French *ch*=*sh* to the same standard as in *chafe*, *chain*, *chamber*, *chance*, *change*, *charm*, *chaste*, *chief*, *choice*, &c.

[Rem.—It is a mooted point among the grammarians whether the French *ch* originally sounded *tsh* and afterwards dropped the *t*, or whether it sounded *sh* from the very first. In case it sounded like *tsh* at first, and dropped the *t* afterwards, we need not assume that the Anglo-Saxon *ch* extended its pronunciation to the French words, but, on the contrary, there would be reason to suppose that the French *ch* imprinted its pronunciation on the Anglo-Saxon *c*. This, indeed, is held by Dr. Ripp (Physiologie d. Sprache, vol. ii, page 90), while *Prof. Diez* asserts (Grammatik d. Romanischen Sprachen, vol. i, first edition, page 196), that the French *ch* sounded like *sh* from the very first. I side with this view of Prof. Diez (although he seems to have given it up in the second edition of his work) for this reason, that the assibilation of *c* before *a* is entirely limited to the French, and in the other Romance languages does not occur except in a few foreign words. Also, it may be seen very readily how *c* was assibilated before *e* and *i*, even when they were not followed by other vowels, because, after the assibilation had once started in those cases where they were followed by other vowels, it naturally extended to all cases whatsoever, where *c* was followed by *e* and *i*; but it did not extend to *c* when followed by *a*, *o*, *u*. We might assume that *y* was inserted before *a*, as in the Icelandic and Danish languages, but this arbitrary insertion of *y* into stems is peculiar to these languages, and is

not customary in the Romance tongues. But, unless *c* before *a* was influenced by a succeeding *y*, it could never have been weakened into *tsh*; for it is only by the dissolving influence of this vowel-consonant that the guttural *c* is changed into the dental *t*.

Prof Diez explains the assibilation of the French *c* before *a* in the following manner: The Franks who conquered France, were unable to pronounce the hard guttural *k*, but instead, pronounced the aspirate *χ* (see Grimm, I, 179). No doubt they pronounced the Romance *c* or *k* in the same manner, and their pronunciation seems to have affected that of the conquered inhabitants of Gaul, who were unable to pronounce the guttural aspirate of the Franks, and in its stead sounded the rough sibilant *sh*. Even at the present day the guttural aspirate of the Spaniards is pronounced *sh* by the French; thus, they say *Don Quichotte* instead of *Don Quixote*. That the French sibilant *ch*=*sh* took its origin from the guttural aspirate, is also proved by its spelling; for *ch* is the German spelling of the guttural aspirate.—The clearest evidence, however, that the assibilation of *c* before *a* was effected by a different process from that before *i* and *e*, is proved by the fact that *c* before *a*, after it was assibilated, sounded like *sh*, but before *e* and *i* like *s*. For, supposing even, that the assibilation of *c* before *i* and *e*, extended to *c* before *a*, we would naturally infer that they would have the same sound, viz., *s*.

In support of the theory, that the sibilation of *c* in *cheek*, *child*, *chest*, &c., took place on Anglo-Saxon ground, and was not caused by the French invasion, I would adduce, that, with the exception of these few words, mentioned above, in the beginning, and a few more at the end of words, as *catch*, *fetch*, &c., *c* remained firm in all other Saxon words, and in English, at the present day, is given by *k*.

The assumption that *e* in *ea* and *eo* was hardened into *y* before the Anglo-Saxon *k*, receives support by Prof. Rask's idea of the pronunciation of these diphthongs; he says in his Anglo-Saxon grammar, § 17: "*E* is used before *a*, *o*, to mark the sound of *y* consonant, as in the most ancient Icelandic orthography, which was probably borrowed from the Anglo-Saxon, *e. g.*, *eorl*, an earl, Old Icel. *earl*, modern *jarl*, &c. It is probable, however, that this sound of *y* has been somewhat weaker than the strong *j*=*y* in Danish, as it occurs so frequently, and is denoted by *e* rather than *i*. It has also been laid aside in many instances; but that it is not a peculiar diphthongal sound that is expressed by this *e* before a vowel, may be inferred as well from the above shown likeness to the Icelandic, as from being often, even in the Anglo-Saxon, interchanged with *i*, *e. g.*, *seo* or *sió*-

cealf or *cielf*," &c. Prof. Grimm objects to Rask's views of the pronunciation of these diphthongs; he says page 258 in a foot-note: "His (Prof. Rask's) reason that the pronunciation *kj*=*ky* is proved by the Ags. *cealf*, *cielf* is unstable, since *ea* is produced from *a*, even when it is not preceded by a *k*, as in *eald*." Still, supposing even that *ea* and *eo* did not sound *ya* and *yo*, as a general thing, and that they were regular diphthongs composed of the vowels *e* and *a* or *o*, there is no reason at all, why we should not admit the hardening of *e* into *y* before *k*, preparatory to the change of this latter letter into *t* followed by *sh*.]

Latin *c*, before *i* and *e*, when imported by the French into England, was equivalent to *s*, and it remained *s*, when it was not followed by another vowel, *e. g*, *centre*, *civil*.

§ 33. Each nation seems to have a particular fondness for some one of the sounds produced by assibilation; so the Italians fancy *tsh* and *dzh*, and to some small extent *ts* and *dz*, the French and Portuguese *sh* and *s*, the Spanish *tsh* and *th*, the Wallachians and Germans *ts*, and the English *tsh* and *dzh*. This fondness the latter show by changing the pronunciation of the French *sh*=*ch* into *tsh*, and the *French zh*=*j*, *ge*, into *dzh*. In French, *c* is found assibilated into *ch*=*sh*, only before *a*, and in such words where there was originally an *a* in Latin, *e. g.*, *cheval* (cabalus), *chemin* (Ital. camino), *chef* (caput); but before *e* and *i* it is reduced into *s*. The reason of this is, that the sibilation of *c* before *e* and *i* commenced in the Latin language itself, and about the sixth and seventh centuries after Christ this was universally pronounced *ts*. In the French the initial *t* was dropped, and *c* before *e* and *i* was pronounced *s*. With *G* it was different; this continued firm and unchanged to a very late period in the Latin language, and, at the time, when the Latin *c* had already become assibilated into *ts*, *g* still preserved its character as a soft guttural consonant, even before *i* and *e*. Towards the close of the Latin language, according to Prof. Diez, I, page 248, 249, 2d edit., it passed over into *dy*=*dj*, and thence into *dzh* in the Italian, and probably also in the early French language, where it speedily lost its initial *d*, and thus became *zh*. In this transformation it was attended by the Latin *y*=*j*, with which it frequently interchanged; thus, both Ital. *giorno* and French *journée* are derived from the Lat. *diurnum*; and in the Middle-age Latin we find *madius*, instead of *majus*. *G* before *e* and *i* and *j* were thus early considered as homogeneous sounds, and continued to be treated as such in the French, where both are pronounced *zh*. From the French this sound was imported

into England by the Normans, but as the Anglo-Saxons had a predilection for *tsh* and *dzh*, in the same manner in which they changed the French *sh*=*ch* into *tsh*, they also converted *zh*=*j* and *g* before *e* and *i* into *dzh*. This pronunciation of *j* and *g* has prevailed in the English language up to the present day.

In words of Anglo-Saxon origin the English preserved *g* from being assibilated even before *e* and *i*, *e. g.*, *give*, *get*, &c.; however, the double Anglo-Saxon *g*, which is spelled *cg*, when a final, became assibilated, so *ecg*, *secg*, *vecg*, *flecg*, *hecge*, *brycg*, *hrycg*, &c., became *edge*, *sedge*, *wedge*, *fledge*, *hedge*, *bridge*, *ridge*. The second final *g* in Anglo-Saxon, according to Prof. Grimm (I, 265), is always produced when the derivative syllable *i* is dropped; thus, *secg* is instead of *segi*, *leegan* for *legjan*, *hrycg* for *hrygi*. From this Dr. Rapp concludes (II, 176), that very probably *g* retained from this original *i* or *y* a tendency to assibilate, when it came under French influence after the conquest. This assibilation of *cg* into *dzh* is analogous to that of *cc* into *tsh*, as in *streccan* (stretch), *vrecca* (wretch), *vicce* (witch), *tviccjan* (twitch), *vacce* (watch), *feccan* (fetch), which is explained by Prof. Grimm (I, 265, 266) in the following way: "When a consonant is doubled, the first is pronounced more strongly, and the second more lightly; hence, in the case of *gg* the first was spelled *c* in Anglo-Saxon, as *secg* instead of *segge*. When *c* was doubled, the second became aspirated before *e* and *i*; because before these vowels every *c* has a tendency to become aspirated; hence the spelling *fecche*, *wrecche*, *cacche*, *wacche*, *kycchen* in the Old English. This *ch*, which originally was a guttural aspirate, gradually partook of the nature of the dental aspirate *sh*, and [we may add, favored by the general fondness of the Anglo-Saxon for the combination *tsh*] *cch* became *tsh*, as in *fetch*, *wretch*, *catch*, *watch*, *kitchen*." In the course of time, *g* and *c*, also, became assibilated in some words after *n*, as in *singe*, *swinge*, *cringe*, *twinge*, and *bench*, *finch*, *drench*.

§ 34. Our investigations have thus far proved that the process of assibilation commenced in the Anglo-Saxon before the Norman invasion. This assibilation commenced with a certainty in *c*, when it was an initial, as in *ceac* which became *cheek*, and it was preparing for assibilation at the end of words, as in *feccan*, *fetian*, which was changed into *fetch*. The sound of the Anglo-Saxon assibilated *c* was *tsh*, which it imprinted upon the French *sh*=*ch* in *chamber*, *chance*, &c. Analogous to the sound *tsh* from *c*, *dzh* was developed from *g*, whether before or after the Norman invasion, is uncertain. This sound was developed in some Saxon words, as in *hricg*, *ridge*, and it also re-

duced the French *zh* in *j*, *ge*, and *gi*, to the same standard as in *just*, *general*, *gist*. In *ce* and *ci* in *centre*, *civil*, &c., the French sound of *c*, viz., *s*, was retained.

There are thus found in the English language of the present day, 1, *the Anglo-Saxon assibilation* of *c* into *tsh*, and of *g* into *dzh*, which reduced to the same standard the French *sh* and *zh*, and 2, *the French assibilation* of *c* into *s*; but in addition to these there is 3, *the English assibilation*, which is a product of the more modern times. This third process is promoted by the modern English tendency of making the accented syllable of a word prominent, and passing quickly over the unaccented syllables. It is by no means as energetic as the previous processes by which the Latin and Anglo-Saxon gutturals were transformed into dentals, and it exercises its influence only upon the dental hard and soft consonants, which it assibilates into *tsh* and *dzh*, and upon the letter *s*, which it thickens into the rough sibilant *sh*. The efficient cause of this assibilation is again *i* in *machine* hardened into *y*, or the short first member of the long sound of *u*, developed into the same letter, acting upon the preceding *t*, *d*, and *s*.

The first step in the modern English assibilation of *t* and *d* consists in imparting to *i* in *machine* the sound of *y*; the conditions under which this is effected have been specified above (§ 27), where it was stated that when *i* in *machine*, before another vowel, is emphasized and pronounced hurriedly, it is developed into *y*. The second step consists in *y* being assibilated into *sh*, when preceded by *t*, and into *zh*, when preceded by *d*. In accented syllables *t* and *d* remain in the first state of assibilation, as in *tube* and *dew* or *duke*; in *dew* we recognize a decided *y*, but in *tube* its vowel-element is almost entirely extinguished by the aspirate following the hard consonant. In unaccented syllables *y* manifests a decided tendency to become assibilated, as in *cordial*, *gradual*, *nature*, *virtue*; indeed, popular pronunciation makes it a general rule to assibilate those letters under these circumstances. In polite pronunciation, however, this tendency of assibilating those letters is checked, and while popular pronunciation is in favor of sounding *celestshal*, *courtshous*, *tĕ-dzhous*, *verdzhŭre*, polite pronunciation says *celestyal*, *courtyous*, *te-dyous*, *verdyŭre*; nay, some orthoëpists deny entirely the existence of *y* in these words, and maintain that *i* in *celestial* is *i* in *pit*.

Walker makes the following remarks on this subject (§ 293): "The tendency of the vowels *i o u* to coalesce after a dental, and draw it to aspiration, makes us hear *tedious*, *odious*, and *insidious*,

pronounced as if written *te-je-us*, *o-jee-us*, and *in-sid-je-us* . . . . . nay, it may be affirmed, that so agreeable is this sound of *d* to the analogy of English pronunciation, that, unless we are upon our guard, the organs naturally slide into it. It is not, however, pretended that this is the politest pronunciation; for the sake of analogy it were to be wished it were: but an ignorance of the real powers of the letters, joined with a laudable desire of keeping as near as possible to the orthography, is apt to prevent the *d* from going into *j* (*dzh*), and to make us hear *o-de-us*, *te-de-us*, &c. On the other hand, the vulgar, who in this case are right by instinct, not only indulge in the aspiration of the *d*, which the language is so prone to, but are apt to unite the succeeding syllables too closely, and to say *o-jus* and *te-jus*, instead of *o-je-us* and *te-je-us*, or rather *ode-yus*, and *tede-yus*." Indeed, so many different opinions prevail with regard to this assibilation of *d* and also of *t* that scarcely any two orthoëpists agree about the pronunciation of some words. Thus, according to Worcester (Dictionary of the English Language, § 24), by Walker, the pronunciation of *Educate* is thus noted, *ĕd'jū-kāt;* by Sheridan, Jones, Enfield, Fulton and Jameson, thus, *ĕd'ū-kāt;* and by Perry, Knowles, Smart and Reid, thus, *ĕd'u-kāt;* by Worcester himself, *ĕd'yūkāte. Nature*, by Walker, thus, *nā'chūr;* by Sheridan and Jones, thus, *nā'chŭr;* by Perry, Enfield, and Reid, thus, *nā'tur;* by Jameson, Knowles, and Worcester, himself, thus, *nāt'yŭr;* by Smart, thus, *nā'tūr* or *nā'chôr.*

After making a careful investigation of the whole subject of the modern English assibilation of *t* and *d*, I have come to the conclusion that this process has not yet settled down into fixed forms; although its proper limits are now much more closely defined, than they were seventy years ago. For, at the time of Nares (see "Elements of Orthoëpy, London, 1784," page 130), it had become customary to assibilate *t* before *u* not only in unaccented but also in accented syllables, while, at the present day, even in the mouth of the people, its assibilation is now generally confined to unaccented syllables. Within the limits of the unaccented syllables, however, a great vacillation is observed even at the present day. In a subsequent part of my investigation, in treating on the pronunciation of the vowels in unaccented syllables, I propose to discuss this subject at full length.

The modern English assibilation of *s*, or rather its thickening into *sh* and *zh*, has become more fixed. This influences not only those words in the English language which are spelled with *s*, as *pension*, *pleasure*, but also those where *c* and *t* were imported into England in

the French assibilated form of *s*. *T* is assibilated in French in all those words where it precedes *i* followed by another vowel, as in *nation, patient, essentiel;* except where it is preceded by *s* and *x*, as in *celestiel, mixture:* there it has the hard sound of *t*, and this it was which was imported by the Normans into England in these words. The former *t*, viz., *t* in *nation*, in English, therefore, comes under the head of *s*, while the latter, viz., *t* in *celestial, mixture*, comes under that of *t;* under this last head, also, comes *t* in *nature*, which is hard in French, but together with *celestial, question, mixture*, is assibilated in English. With regard to the peculiar process by which *s* is thickened into *sh* and *zh*, this is again owing to the following *i* hardened into *y*. With *s* we find *fusion, cession, treasure, nauseous, sensuous, usual, transient;* with *t, militia, nation, tertian, initial, patient, seditious;* with *c, acacia, social, logician, ocean, ancient, species, precious, cretaceous.* In *sure*, *s* is thickened even in an accented syllable. The only instances where *s* is not thickened when followed by *i* or *e*, are *enthusiasm, gaseous, gypseous, exosseous.* In *calceated, halcyon, cynosure, caseous*, the authorities are divided.

With regard to the complete absorption or partial retention of the vowel *i* or *e*, after assibilating the preceding *t*, *d*, or *g*, or thickening the preceding *s*, as in *social* and *associate, ambrosia* and *cassia, theologian* and *Stygian*, &c., it will be discussed fully in a subsequent part.

§ 35. There now only remains for me to present in a synopsis the results of our preceding investigation:

I. Combinations of W and the Consonants and Semi-Vowels.

a. *After Consonants:*
hw (white), *tw* (twang), *dw* (dwarf), *kw* (quarter), *gw* (language), *thw* (thwart), *sw* (sweet).

b. *Before Consonants and Semi-Vowels; where w is mute:*
wh (who), *wr* (write).

II. Combinations of Y with the Consonants and Semi-Vowels.

Combinations acknowledged by Orthoëpists generally.
ty (Christian), *dy* (Indian).
ly (bullion), *ny* (onion), *ry* (clarion).

III. Combinations obtained by Assibilation.

1. Anglo-Saxon Assibilation.

a. *Assibilation of C, K:*
tsh (*cheek, fetch, bench*).

French *sh* changed into *tsh* (*chafe, chance*).

b. *Assibilation of G:*
dzh (*ridge, edge*).
French *zh* changed into *dzh* (*gender, gist, joy*).

2. French Assibilation.

Assibilation of C:
s (*centre, civil*).

3. Modern English Assibilation.

a. *Assibilation of T:*
ty (*tube, Christian*), *tsh* (*question, nature*).

b. *Assibilation of D:*
dy (*tedious, dew*), *dzh* (*cordial, soldier*).

c. *Assibilation of S*, i. e. *S proper and French S in ti, ci, and ce:*
s thickened into *sh* (*pension, treasure, transient*).
French *s* in *ti* thickened into *sh* (*nation, patient*).
French *s* in *ci* and *ce* thickened into *sh* (*social, precious, ocean*).

CHAPTER XI.

ON CONSONANTAL TRIPHTHONGS.

§ 36. These combinations in stems are mere amplifications of the semi-vowel diphthongs; thus, in the beginning of words they must always end either in *r* or *l*, and at the end of words they may begin with any of the semi-vowels generally. In English, at the beginning of words, we only find combinations commencing with *s*, as *spl* in *spleen*, *spr* in *spring*, *str* in *string*, *skr* in *screw*, and *skl* in the old word *sklere;* with the vowel-consonant *w* as its last member we find the triphthong *skw* in *squall*. At the end of words we find *rld* in *world*, *rst* in *worst*, *first*, *burst*, *rtsh* in *march*, *search*, *rdzh* in *large*, *gorge;* with *l* we find *lst* in *whilst*, *lfth* in *twelfth*, *lkt* in *mulct;* with *m*, *mpt* in *contempt*, *mps* in *glimpse;* with *n*, *ntsh* in *bench*, *ndzh* in *fringe;* with guttural *n*, *nkt* in *distinct*, *nks* in *minx*. The only triphthong without a semi-vowel is *kst* in *text*. In addition to these there are, however, many combinations ending in *s*, or *d* and *t*, which are obtained by the inflexion of nouns and verbs, as *kts* in *acts*, *sps* in *hasps*, *fts* in *rafts*, *sts* in *lasts*, *sks* in *flasks*, *spt* in *lisped*, *skt* in

asked, and numberless combinations with the semi-vowels, as in *arms, barns, elms, kilns, harps, herbs, parts, herds, parks, helps, bulbs, salts*, &c., and with *t* or *d*, in *limped, linked, starved, singed*, &c.

Among dissyllables and polysyllables generally we may distinguish three classes of words: 1. Such as have become dissyllables by prefixes, as *enclose, complete*, &c. 2. By suffixes, as *kindred, children;* and 3, such as are regular compounds of two nouns, adjectives, &c., as *landmark, bookcase*, &c. Those of the last-named class are necessarily not as closely conjoined as the former, and there is no end, consequently, to the triphthongs that may be obtained in this manner, as in *beartrap, bedstead, beefsteak, blacksmith*, &c. Those triphthongs which are obtained by prefixes, are limited to combinations beginning with *b, k, s, m, n*, and *r*. With *b*, we find them in *abstain, obscure, substance;* with *k* in *extirp*, with *s* in *disgrace*, *m* in *circumspect, complain, employ, improve*, *n* in *congress, inflate*, *r* in *perspire*. A greater freedom prevails in the combinations obtained by suffixes, as in *paltry, spinster*, &c.; or where the second noun of the composition has dwindled down to a mere suffix, as in *palfrey, osprey*, &c. Among this class we distinguish three kinds of composition, 1, where the first and third members are semi-vowels, and where there is a consonant in the middle, as in *fortress, culprit, kindred*, &c. 2, where the semi-vowel is the first member, and is followed by two consonants, as in *bolster, spinster*, &c., and 3, where the semi-vowel is the last member, and is preceded by two consonants, as in *frustrate, osprey*. The greatest number of combinations we find in the first class. With *r* as first and last members, we find *rtr* in *fortress, portress, Bertram, Gertrude;* with *r* first and *l* last, *rgl* in *burglar;* with *r* first and *m* last, *rtm* in *department, mortmain*. With *l* first and *r* last, we find *lpr* in *culprit, lfr* in *palfrey, ltr* in *filtrate, paltry, sultry, ldr* in *caldron, children, lkr* in *fulcrum*. With *m* first and *r* last, we find *mpr* in *lamprey, mbr* in *cambric, membrane, mfr* in *Humfrey;* with *m* first and *l* last, *mpl* in *templar, exemplar, mbl* in *tumbler, gambler*. With *n* first and *r* last, we find *ntr* in *sentry, entry, huntress, ndr* in *kindred, tendril, hundred;* with *n* first and *l* last, *ntl* in *gauntlet*. With guttural *n* and *r*, we find *ngr* in *hungry*. Among the combinations of the second class, with the semi-vowel first and two consonants afterwards, we find combinations with *r* in *torsten*, with *l* in *bolster, soldier*, with *m* in *Simpson, redemption, sumpter, rhymster*, with *n* in *spinster*, with guttural *n* in *sphincter, tungsten*. Among those triphthongs ending in semi-vowels, we find *str* in *frustrate, ostrich*,

mistress, &c., *spr* in *osprey*, *stl* in *restless*, &c., *ctr* in *victress*, *actress*, *dfr* in *Godfrey*. Triphthongs composed of consonants alone are *pst* in *capstan*, *bst* in *lobster*, *kst* in *huckster*. The triphthongs of the second class which end in consonants, are also found at the end of words, as *rst* in *burst*, *ldzh* in *bulge*, *mps* in *lamps*, *mpt* in *contempt*. But the triphthongs of the first and third class, when placed at the end of words, lose their character as triphthongs, and the last semi-vowel is pronounced in such a manner as to seem to constitute a syllable by itself, as in *centre*, *crumble*, &c. Among those combinations which are spelled as triphthongs, we find a few ending in *r*, as *ntr* in *centre*, *antre*, *nkr* in *chancre*, *ptr* in *sceptre*, *str* in *lustre*, *ktr* in *spectre*. All other combinations terminate in *l*. With *r* as their first member, we find *rpl* in *purple*, *rbl* in *marble*, *rtl* in *turtle*, *rdl* in *curdle*, *rkl* in *circle*, *sparkle*, *rgl* in *gargle*. Among those combinations beginning with the nasals, we see their affinity for their respective consonants demonstrated. So we find *mpl* in *ample*, *pimple*, *temple*, *mbl* in *amble*, *crumble*, *nimble*, &c., *ntl* in *mantle*, *pintle*, *ndl* in *bundle*, *candle*, *fondle*, *nkl* in *ankle*, *rankle*, *ngl* in *angle*, *dangle*, &c. *T*, when it is the second member of a triphthong, becomes quiescent, as in *btl* in *subtle*, in *stl* in *hostler*, *castle*, *bustle*, *bristle*, *whistle*, &c., *k* in *muscle*, *p* in *empty*.

§ 37. Combinations of four consonants and semi-vowels occur in compositions of two nouns, as in *feldspar*, *palsgrave*, *spendthrift*, &c.; by prefixes, we get *abstract*, *adscript*, *conscript*, *explain*, *express*, *extra*, *instruct*, *abstract*, and by suffixes, *minstrel*, *temptress*, *seamstress*, *songstress*, *dextral*.

§ 38. In the following scheme are exhibited the various triphthongal combinations:

I. Triphthongs in Monosyllables.

a. *At the Beginning of Words:*

spl (spleen), *spr* (spring), *str* (string), *skr* (screw), *skl* (sklere), *skw* (squall).

b. *At the End of Words:*

rld (world), *rst* (worst), *rtsh* (march), *rdzh* (large).
lst (whilst), *lfth* (twelfth), *lkt* (mulct).
mpt (contempt), *mps* (glimpse).
ntsh (bench), *ndzh* (fringe).
nks (minx).

c. *Triphthongs composed of Consonants only:*

kst (text).

d. *Triphthongs obtained by Inflexion:* in *acts, hasps, rafts, lasts, flasks, lisped, asked, arms, barns, elms, kilns, harps, herbs, limped, linked, starved, singed,* &c.

II. Triphthongs in the Middle of Words.

1. *By Composition of two Nouns:*

In *bedstead, beefsteak, blacksmith,* &c.

2. *By Prefixes:*

In *abstain, obscure, substance; extirp; disgrace; circumspect, complain, employ, improve; congress, inflate; perspire.*

3. *By Suffixes.*

a. *With Semi-vowels as their first and last members:*
rtr (fortress), *rgl* (burglar), *rtm* (department).
lpr (culprit), *lfr* (palfrey), *ltr* (filtrate), *ldr* (caldron), *lkr* (fulcrum).
mpr (lamprey), *mbr* (cambric), *mfr* (Humfrey), *mpl* (templar), *mbl* (tumbler).
ntr (entry), *ndr* (kindred), *ntl* (gauntlet).
ngr (hungry).

b. *The Semi-vowels as first members, followed by two Consonants:*
rst (torsten), *lst* (bolster), *ldzh* (soldier), *mps* (Simpson), *mpsh* (redemption), *mpt* (sumpter), *mst* (rhymster), *nst* (monster), *ndzh* (angel), *nkt* (sphincter), *ngst* (tungsten).

c. *The Semi-vowels as last members, preceded by two Consonants:*
str (frustrate), *spr* (osprey), *stl* (restless), *ktr* (actress), *dfr* (Godfrey).

d. *Triphthongs composed of Consonants only:*
bst (lobster), *kst* (huckster), *pst* (capstan).

III. Spurious Triphthongs.

a. *Ending in R:*
ntr (centre), *nkr* (chancre), *ptr* (sceptre), *str* (lustre), *ktr* (spectre).

b. *Ending in L:*
rpl (purple), *rbl* (marble), *rtl* (turtle), *rdl* (curdle), *rkl* (sparkle), *rgl* (gargle), *mpl* (ample), *mbl* (amble), *ntl* (mantle), *ndl* (candle), *nkl* (ankle), *ngl* (angle).

c. *The middle Consonants suppressed:*
t in *btl* (subtle), *stl* (bustle).
k in *skl* (muscle).
p in *mpt* (empty).

IV. Combinations of Four Consonants and Semi-vowels.

a. *By Composition of two Nouns:*
In *feldspar, palsgrave, spendthrift,* &c.

b. *By Prefixes:*
In *explain, express, extra, instruct, obstruct.*

c. *By Suffixes:*
In *minstrel, temptress, seamstress, songstress, dextral.*

CHAPTER XII.

SYLLABIFICATION.

§ 39. We may look upon the words of language from two points of view. *First,* we may take an etymological, and, *secondly,* a phonological view of them.

Etymology teaches us that in the Arian family of languages all stems were originally monosyllabic. These, in the course of time, by derivation, became polysyllabic. Etymology very carefully points out these monosyllabic stems, and explains the origin and the use of the several prefixes and suffixes which were subsequently added to them. An etymological division of a word into its component parts, therefore, consists in its resolution into those syllables of which it had been originally composed.

Phonology proceeds otherwise. It takes the words of language as it finds them, without investigating the manner in which they have been produced. Phonologically considered, each word is composed of one or several articulations or joints. Each of these joints consists of a vowel which is either entirely open, as in *I, a-orta, o-asis, ide-a,* or else partially or entirely surrounded by semi-vowels and consonants, as in *to, in, put, sport.* The joints are called *open* when the vowels are not followed by any semi-vowels or consonants, as in *so, me, di-al, bri-ar,* &c., and they are called *closed* when they are followed by one, two, or three consonants and semi-vowels, as in *an, ship, park, thirst.* Each word may be divided into its respective joints, but these joints are not the same with the etymological syllables. Sometimes they agree, as in monosyllables; but, in polysyllables, they very frequently disagree.

In order to tell correctly the phonological articulations or joints of words, we must have clear ideas of the manner in which the several

sounds composing them are enunciated. The vowels may be pronounced in three different ways. In accented syllables, they are either long or short, and in unaccented syllables they are more or less reduced. The *long* vowels are pronounced loud in the beginning, but the voice tapers off towards their close. They present, therefore, quite a small front to the following consonants and semi-vowels. The *short* vowels, on the other hand, instead of decreasing, seem rather to expand during their short existence, and to rush with full force against the following consonants. The *reduced* vowels, finally, which are only found in unaccented syllables, are of an indifferent kind, and neither increase nor decrease their small compass; still, in some cases, they partake somewhat of the nature of the short vowels. The long vowels, therefore, combine in a different manner with the following semi-vowels and consonants than the short; the former establishing quite a slight conjunction with them, but the latter an intimate one. The connection of the reduced vowels, also, with the succeeding consonants and semi-vowels, is as lax as that of the long vowels.—The consonants and semi-vowels, again, are pronounced in a different manner when preceded by long and reduced and when by short vowels. In the former case, their initial element is very weak and scarcely audible, but in the latter it is quite emphatic; hence, after short vowels, the consonants and semi-vowels are said to be sharpened.

§ 40. When one joint ends in a vowel, and another begins with one, their division does not present any difficulty; for, although no break of the voice occurs in their pronunciation, still there is a change operated in the configuration of the organs of speech, by which change the former vowel is suddenly brought to a close, and passes over into the following. The break in these words, therefore, naturally occurs after the first vowel, *e. g., a-orta, li-ar, May-o, ide-a.*

§ 41. When a consonant or semi-vowel is between the two vowels, the case is more intricate. All articulated sounds, excluding the vowels, may be divided into continuants and explodents. The continuants include the fluid consonants and the semi-vowels, and the explodents the hard and soft. When continuants are medial, there is no actual break in the word either; for they form a continuous passage from one vowel to another. Still, there are indentations noticed which point out the terminations of the joints. When the vowel, in the first joint, is long, the indentation is immediately after this vowel; for the voice in its pronunciation tapers off, and the long vowel is thus connected but very slightly with the following continuant. When

the long vowel is followed by an explodent, there is actually a break between the two; for the initial element of an explodent, after a long vowel, is silent, while that of a continuant is heard. Compare *pa-per* and *clai-mant*. This also applies to those words where the semi-vowels *r* and *l* furnish the vowel element of the second syllables. The break in these words is immediately after the long vowels, as in *sa-bre, ni-tre, a-cre, o-gre, sta-ple, a-ble, bi-ble, ti-tle, cra-dle, ca-gle.* When the preceding vowel is short, the initial element of the following continuants or explodents is intimately connected with it. This, therefore, forms a part of the first joint, but their final element is just as intimately connected with the following vowel, and, therefore, forms a part of the following joint. With the continuants, therefore, when a word is pronounced slowly, there is an indentation, and, with the explodents, a break between their initial and final elements whenever they are preceded by short vowels.

On account of the clear enunciation of both elements of the medial continuants and explodents, when preceded by a short vowel, they are frequently doubled in spelling, as in *hammer, bonnet, marry, blossom, coffer, rabbit, bladder, waggon*, &c. The first letter, in these instances, stands for the initial, and the second for the final element; but, sometimes, the short vowels are followed by single continuants and explodents, as in *rapid, robin, Latin, timid, valor, arid.* The question here arises whether these medial letters belong to the first or to the second joint. It is true that this question is one of orthography merely; for, although spelled with one letter only, the initial and final elements in these continuants and explodents are as clearly pronounced as when they are spelled double; thus, *rapid, robin, Latin, timid*, &c., we pronounce as if spelled *rap-pid, rob-bin, Lat-tin, tim-mid.* The question, then, to which of these two syllables these medials are to be adjoined in spelling, is simply resolved into this: Which one of these two elements, the initial or the final, is the most important? I unhesitatingly reply, the initial; for this, at all events, commences the letter, and is most intimately embraced by the preceding vowel. Still, this affinity of the initial element of medial continuants and explodents for the preceding vowels is limited to those cases where they are preceded by short vowels, and does not extend to the preceding long and reduced vowels. In both these cases, the final element prevails over the initial, and the continuants and explodents, therefore, are drawn into the following syllables. In the case of the long vowels, this has been shown above, but in that of the reduced, the following examples may be adduced: *re-lief', ce-chin', pe-ruse', che-*

roots', *me-chan'-ic*, *e-pis'-tle*, *ce-les'-tial*, *me-mo'-rial*, *de-cim'-e-ter*, *me-dic'-i-nal*, *pe-nin'-su-la*, &c. It will be remembered that the reduced vowels occur in unaccented syllables, whether before or after the accented syllables. As soon as the reduced vowels are removed two syllables from the accented one, and receive the secondary accent, and, by virtue of this accent, from reduced are made short, they exercise their power of attraction over the following continuants and explodents, and draw them into the same joints with themselves, *e. g.*, *bec'-a-fi'-co*, *ec'-o-nom'-ic*, *ed'-i-to'-rial*, *el'-o-cu'-tion*, *cer'-e-mo'-nious*, *cat'-e-chet'-ic*, *et'-y-mol'-o-gy*, *mer'-i-to'-rious*, *cin'-e-rit'-ious*, *ref'-or-ma'-tion*, *res'-o-lu'-tion*. When reduced vowels follow the accented syllables, the case is the same. They have no power to draw the following continuants or explodents into their own syllables, *e. g.*, *ap'-pe-tite*, *com'-e-dy*, *se'-cre-cy*, *su'-re-ty*, *bul'-le-tin*, *ar'-se-nal*, *cal'-ce-don*; but as soon as they receive the secondary accent, the initial overcomes the final element, *e. g.*, *cem'-e-ter'-y*, *cac'-o-chym'-y*, *pal'-i-nod'-y*, *cel'-i-bas'*(c)*-y*, *del'-i-cac'-y*, *am'-a-tor'-y*, *mon'-i-tor'-y*. When the vowel, in an unaccented syllable, is followed by two consonants or semi-vowels, it does not become reduced to the same degree as when it is followed by a single consonant, and sufficient power remains to it to attract one of the two consonants, as in *ver-bose'*, *es-carp'*, *ad'-ver-tise'*, *ges-ta'-tion*, *ser-pi'-go*, *sen-ten'-tious*, *ven-tril'-o-quy*, and, also, in *trav'-es-ty*, *lib'-er-ty*, *cal'-en-der*, *an'-ec-dote*. Still, when the two consonants *k* and *s* are expressed by the letter *x*, the preceding unaccented vowel has no power to appropriate it, *e. g.*, *an'-ne-xa'-tion*, *cach'-e-xy*.

§ 42. When two continuants or explodents are medial, they present one of the following combinations: 1, two explodents; 2, one explodent followed by a continuant; 3, a continuant followed by an explodent; and 4, two continuants. The combination of two explodents, as in *pt*, *kt*, is equivalent to that of a double mute; for, as in *wag-gon*, the first *g* represents the initial, and the second the final element, so also in *actor*, *baptist*, *k* and *p* are pronounced by the closing, and *t* by the opening of the articulating stations, as has been shown above in the article on consonantal diphthongs. (The same division applies to those words where the semi-vowels *r* and *l* furnish the vowel element of the second syllables, as in *sceptre*, *spectre*, where the break occurs between the two mutes, viz., *scep-tre*, *spec-tre*. In *subtle*, *b* is quiescent, and the vowel, in pronunciation, combines immediately with *t*; this word, therefore, is divided thus, *subt-le*.) This is still more the case when these combinations occur in compound words, where

the second syllables are likewise accented, as in *cock-tail*, *hip-tile*, *dog-day*, and also in *foot-path*, *cud-bear*, &c. The same also applies when two explodents are preceded by an unaccented vowel, for the vowel in this instance, as has been mentioned above, is not reduced in the same degree as when it is followed by a single explodent, and therefore, sufficient power remains to it to attract one of the following letters, as in *ac-tae'-a*, *bap-tis'-tic*, *cap-ta'-tion*, *ac-cep-ta'-tion*. When two explodents are between two unaccented vowels, each one lays, likewise, claim to one of these letters, *e. g.*, *am'-phic-ty-on'-ic*, &c. When an explodent precedes a continuant, and this is a semi-vowel, these combinations may be preceded either by a long or short vowel. When the vowel is long, the break occurs immediately after the vowel, as in *A-pril*, *ma-tron*, *fra-grant*, *vi-brate*, *ni-trate*, *mi-grate*, *He-brew*, *pe-trous*, *ca-the-dral*, *se-cret*, *ne-gro;* when it is short, the break is found between the initial and final elements of the preceding mutes, and the following words are pronounced as if they were spelled *lep-prous*, *cit-tron*, *mid-driff*, *pop-plar*, *pub-blic*, *Dud-dley*, *mot-tley*, *ug-gly*. Such, also, is the case when the continuant is a fluid consonant, as in *hat-chet* (hatchet), *jud-dzhing* (judging), *rup-pshon* (ruption), *ak-kshon* (action), *ak-ksent* (accent), *ek-ksile* (exile), *drop-psy* (dropsy), *top-pful* (topful), *book-kful* (bookful), &c. In English orthography, these words are all spelled with single letters, with the exception of *doggrel*, which may be fairly divided into *dog-grel;* but as to the question whether the single letters in these combinations are intended to mark the initial or final element of the mutes, I again declare in favor of the initial element, as in all other cases, whenever the mutes are preceded by short vowels. In practical spelling, the above words may thus be divided in the following manner: *lep-rous*, *cit-ron*, *mid-riff*, *pop-lar*, *rup-tion*, *ac-tion*, *ac-cent*, *drop-sy*, *top-ful*, *book-ful*. The words *hat-chet* and *jud-ging*, also, we may divide in a strictly phonetic manner, as *ch* and *g* in these words, are equivalent to *tsh* and *dzh;* the insertion of *t* and *d* in these words, which facilitates their syllabication, may be considered an argument, showing that English orthography is not quite as irrational as it is generally reputed to be. A difficulty arises in *exile*, where half of *x* belongs to the first, and the other half to the second syllable. This point the English language settles on etymological grounds, for it decides that compound words in syllabication are divided into their constituent members; thus we divide *ex-ile*. When preceded by a reduced vowel, *x* belongs to the following syllables, as in *cach-e-xy*.

Sometimes it is difficult to tell the precise place where polysylla-

bles are jointed, and in order to detect their breaks and indentations, we must pronounce them very slowly, and then notice that portion of the word on which our voice naturally rests, and which it protracts; this is always the last letter of the joint. So in *pa-per*, we rest on the vowel *a*, and prolong it in *tim-id* on *m*, and in *cit-ron* on *t*; there, indeed, the voice does not continue to sound, yet the organs of speech preserve the configuration of *t*. The combinations of a continuant with an explodent we find preceded both by long and short vowels. They are preceded by a long vowel in *carpet*, *shoulder*, and by a short one in *alpine*, *sultan*. In pronouncing slowly *carpet*, *shoulder*, we dilate both upon the vowels and the following semi-vowels, and finally, land quietly in the following mutes, while in *alpine*, *sultan*, we pass speedily over the vowels and semi-vowels, and rush quickly against the following mutes. So, also, in *after*, *basket*, we proceed slowly towards the medial explodents, but in *sister*, *vespers*, we reach them quickly. The effect of the preceding long vowels and continuants upon the following mutes, is to render their initial element perfectly inaudible, whilst it is clearly distinguished when preceded by a short vowel and a short continuant. Thus, phonology divides *car-pet*, *or-bit*, *gar-ter*, *mar-ket*, *or-gan*, *shoul-der*, *mal-kin*, &c., but *vulp-ine*, *alb-um*, *sult-an*, *fulg-or*, *damp-er*, *emb-er*, *tend-on*, *clink-er*, *fing-er*. This distinction also extends to those cases where the semi-vowels *r* and *l* furnish the vowel element of the succeeding syllables; thus we divide *mar-ble*, *star-tle*, *spar-kle*, *gar-gle*, but we say *amb-le*, *ank-le*, *dan-gle*, *pur-ple*, *turt-le*, *lust-re*. Still, although the preceding short vowels have a tendency to draw the explodents, after the continuants, into the first syllable, it is doubtful whether it is advisable to carry out this distinction in practical syllabication, especially since this is not productive of alteration in the pronunciation of these words. I therefore propose to divide those words where the combination of a continuant and a mute is preceded by a short vowel, in the same way as when it is preceded by a long vowel, and thus to syllabize *vul-pine*, *al-bum*, *sul-tan*, *ful-gor*, *dam-per*, *em-ber*, *ten-don*, *am-ble*, *pur-ple*, *tur-tle*, *lus-tre*; with the exception of *clink-er*, *fing-er*, *an-kle*, *dang-le*, where for orthographical reasons the gutturals cannot be separated from the nasals, and of *st* in *Ha-stings*, *cha-sten*, &c., where both letters are pronounced with the last syllable. When the following syllables are likewise accented, they always attract the preceding mutes, e. g. *har-poon*, *gar-boil*, *pan-dect*, *bel-dam*, *sun-burnt*, *man-kind*, *wash-tub*, *Glas-gow*, &c. The same is the case when this combination is preceded by a

reduced vowel, as in *ap'-os-tume, ap'-er-ture, bal'-der-dash, cal'-en-der, cham'-per-tor, mod'-es-ty, lib'-er-ty, prot'-es tant,* &c.; also in *ar'-en-ta-tion, cer-tif'-i-cate, ges-ta'-tion, len-ti'-go, mer-cu'-ri-al, ser-pi'-go, ver-bal'-i-ty, ver-tic'-i-ty,* and when the vowel has the secondary accent, as in *col'-ber-tine, as'-per-na'-tion, es'-ca-lade', res'-ti-tu'-tion.* When two continuants are medial, the voice rests on the first and protracts it; hence, the break occurs in the middle between the two letters, as in *bar-ley, mar-mot, fur-nish, fil-my, al-nage, em-rod, hem-lock, Hen-ry, dun-lin, Eng-lish, or-phan, mar-vel, mar-shal, el-fin, cen-sus, an-them, fren-zy,* &c. Some of these words have a tendency to draw both continuants into the first syllable, as *furn-ish, film-y, orph-an, marv-el, marsh-al, elf-in,* but it is questionable whether this tendency ought to be indulged in practical syllabication. When a reduced vowel precedes, the break is still in the middle between the two continuants, as in *rit'-or-nel, cham'-ber-lain, sol'-em-nize, Ber-mu'-das, ver-nac'-u-lar, cen so'-ri-ous,* and also when the vowel has the secondary accent, as in *mal'-ver-sa'-tion, ster'-nu-ta'-tion.*

§ 43. When triphthongal combinations of continuants and mutes are medial, the break is always immediately after the first continuant or mute, e. g., *for-tress, bur-glar, cul-prit, pal-frey, fil-trate, cal-dron, ful-crum, lam-prey, cam-bric, Hum-frey, tem-plar, tum-bler, en-try, kin-dred, tor-sten, bol-ster, sol-dier, Sim-pson, redem-ption, sum-pter, rhym-ster, mon-ster, an-gel, tung-sten, frus-trate, os-prey, ac-tress, God-frey, lob-ster, huck-ster, cap-stan.* In *hungry, sphincter,* for orthographical reasons, we must divide *hung-ry, sphinc-ter.*

§ 44. When combinations of four continuants and mutes are medial, the break is invariably after the first member; thus, we say *min-strel, tem-(p)tress, song-stress, dec-stral* (*dex-tral*).

§ 45. Practical English syllabication is a compromise between the etymological and phonological division of words. The etymological division is resorted to:

1. In all words compounded of two independent English words, whether they be nouns, adjectives, verbs, prepositions, or any other parts of speech, e. g., *short-hand, bug-bear, cut-throat, book-ful, off-hand, up-hold, with-draw, mis-take,* &c.

2. In such words where suffixes are appended, and where, after dropping the suffix, we obtain a simple English word, *e. g., connect-ed, treat-ed, silk-en, oak-en, eat-en, chick-en, eat-er, drink-er, old-er, east-ern, west-ern, nail-ery, brew-ery; count-less, heir-ess, art-less, blame-less; branch-let, stream-let; pave-ment, punish-ment, apt-ness, good-ness, bind-ing, sing-ing; cat-kin, lamb-kin; bird-ling, dump-ling; court-*

ship, clerk-ship; wise-ly, brother-ly; duke-dom, king-dom; blithe-some, hand-some; boy-hood, man-hood; bliss-ful, spoon-ful, &c. Still, this rule cannot be carried out in all cases, for, in order to preserve the correct pronunciation, we must divide *ta-ken, ma-ker, ba-kery, fla-ming.* When any of the above suffixes belong to simple words, as in *open, garden, oven, Peter, anger, muster, flutter, lucern,* &c., or when the simple words are dissyllables, contracted into monosyllables, before the suffixes are appended to them, as in *brethren, huntress, portress, mistress,* &c., the division into syllables is made according to the phonological laws, viz., *o-pen, gar-den, ov-en, Pe-ter, an-ger, mus-ter, flut-ter, lu-cern, breth-ren, hunt-ress, port-ress, mist-ress.*

3. In such words of Greek and Latin descent, which are generally recognized to be compounded even by non-classical scholars, *e. g., demo-cracy, ortho-doxy, poly-gamy, geo-gnosy, cosmo-gony, theo-logy, soli-loquy, pyro-latry, logo-machy, geo-mancy, poly-mathy, geo-metry, astro-nomy, mono-poly, allo-pathy, horo-scopy, philo-sophy, ana-tomy.* Still, it would be advisable to divide these words according to the phonological laws, e. g., *de-moc-ra-cy, or'-tho-dox-y, po-lyg'-a-my, ge-og-no-sy, cos-mog'-o-ny, the-ol-o-gy,* &c.

4. All prefixes usually form separate syllables, e. .g, *ab-ominate, ad-orn, be-long, con-sider, contra-dict, circum-vent, di-gest, dis-use, de-dicate, e-licit, ex-ile, in-oculate, intro-duce, inter-val, ob-tuse, per-ceive, pre-dicate, post-pone, retro-spect, pro-mote, re-formation, se-duce, sub-ordinate, super-add, trans-act,* &c. It is questionable, however, whether it would not be much better to divide all these words according to the phonological laws, viz., *a-dorn, ded-i-cate, pred-i-cate, tran-sact,* &c.

An etymological division of words is artificial. It may please the eye to have words divided etymologically at the end of a line, yet for the purposes of exhibiting the true pronunciation of a word, in pronouncing dictionaries and spelling books, they ought always to be divided phonologically. It will be seen in a subsequent part that a knowledge of the true articulation of English words is of great importance in order to solve satisfactorily the problem of English pronunciation and orthography.

§ 46. I now propose to state the *Principles of Phonological Syllabification* in English:

1. When two vowels meet in a dissyllable, the first belongs to the preceding, and the second to the succeeding syllable, viz., *cha-os, Sto-ic.*

2. When one continuant or explodent is medial, and this is preceded by a long or reduced vowel, the following continuant or explodent belongs to the second syllable, *e. g.*, *pa'-per, sce'-ne-ry, me'-liorate, re-lief', me-chan'-ic, me-dic'-i-nal.* When it is preceded by a short vowel, or by a vowel with the secondary accent, it belongs to the preceding vowel, *e. g.*, *rap'-id, el'-e-gance, pref'-a-tor'-y, et'-y-mol'-o-gy, cem'-e-ter'-y.*

3. When two continuants or explodents are medial, the first belongs to the preceding, and the second to the succeeding syllable, *e. g.*, *ac-tor, cit-ron, al-pine, fur-nish;* except when a long vowel precedes the combination of an explodent followed by a continuant, *e. g.*, *matron;* and also when it precedes the combination *st* in *Ha-stings*, &c.

4. When three continuants and explodents are medial, the first always belongs to the preceding, and the two others to the succeeding syllables, viz., *fil-trate, lob-ster.*

5. When four continuants and explodents are medial, the first belongs to the preceding, and the remaining three to the following syllable, *e. g.*, *min-strel.*

[Rem.—A great disagreement prevails among the orthoëpists and grammarians on the subject of syllabification. *Murray, Walker*, &c., hold, that when one consonant or semi-vowel is medial, it always belongs to the following vowel; thus, the former divides *gra-vel, fi-nish, me-lon, bro-ther, bo-dy, wi-dow, pri-son, a-va-rice, e-ve-ry, o-ran-ges, e-ne-my, me-di-cine, re-pre-sent, re-so-lu-tion. Ellis*, on the other hand (Essentials of Phonetics, page 67), holds that when one vowel is found between two vowels, it ought to be taken with the first syllable, when it is either long or short, and with the second when it is reduced. *Goold Brown* (Grammar of English Grammars, page 180) says: "Consonants should generally be joined to the vowels or diphthongs which they modify in utterance, as *An-ax-ag-o-ras, ap-os-tol-i-cal;*" and in some other places he divides *riv-er, fe-ver, or-thog-ra-phy, the-ol-o-gy, di-vis-i-bil-i-ty.* His mode of syllabizing seems to agree in general with the principles laid down by myself; but, as his examples are limited to the above words, I do not exactly know whether we both agree with regard to the attractive power of a preceding reduced vowel; so, for instance, I would divide *An-a-xag-o-ras*, and not *An-ax-ag-o-ras.* The great difference between English syllabication and that of all other languages arises from its great number of reduced vowels, which exercise but a small attractive power on the following consonants. Unless we clearly point out this feature in spelling, we cannot give a correct idea of the articulation of English words, and, consequently, of their pronunciation.]

Stated Meeting, November 1st, 1861.

Present, twelve members.

Professor CRESSON, Vice-President, in the Chair.

Donations for the Library were announced from the Rhode Island Society for the Encouragement of Domestic Industry, the Academy of Natural Sciences of Philadelphia, the editors of the Medical News and Library, the Superintendent of the United States Coast Survey, and Prof. E. O. Kendall.

The committee to which was referred the communication of Dr. Mitchell reported in favor of its publication in the Transactions, and it was so ordered.

Dr. Coates gave a specific reference to Jefferson's correspondence in reference to a point of the discussion at the last meeting.

Mr. Powel made some remarks upon the progress of the flax-cotton manufacture in New England and New York, for which the chief desideratum has been a uniform staple, which seems now attainable by passing the fibres between rolls under graduated pressure.

Pending nominations Nos. 425 and 426 were read.

On motion of Dr. Bache an appropriation was made for printing the paper book of the Society in the case now before the court, argued by Mr. Price.

And the Society was adjourned.

Stated Meeting, November 15th, 1861.

Present, fifteen members.

Professor CRESSON, Vice-President, in the Chair.

Prof. Brown of Heidelberg, lately elected a member of the Society, made known his acceptance of membership through the President, Dr. Wood, whose letter to the Secretary, dated Copenhagen, Oct. 16, 1861, was read.

Letters acknowledging the receipt of publications were read

from the Natural History Society at Moscow, dated Dec. 15-27, the London Ethnological Society, dated March 20, the National Museum of Antiquaries at Edinburgh, dated April 13, and the Smithsonian Institution, dated Washington, May 9, and June 28, 1861.

Donations for the Library were received from the Smithsonian Institution, the Franklin Institute, the Protestant Episcopal Church of Pennsylvania, Dr. Tafel, Professor Tafel, of St. Louis, Mr. Lea, Mr. Foulke, and Dr. Emerson.

Copies of the paper book were laid upon the table by Mr. Price.

The death of M. Von Abrahamson, of Copenhagen, January 6, 1849, was announced.

Dr. Emerson called the attention of the members to the importance of phosphoric acid in agriculture.

The agency exercised by phosphoric acid upon growing plants has been one of the most important results of the investigations of men of science, who have devoted their attention to organic chemistry and its bearings upon agriculture. Baron Liebig has thrown out the most interesting information upon the subject, and Elie de Beaumont has made a rich communication to the National Institute of France, upon the agricultural value of phosphoric acid. He regards this as the main element imparting fertility to soils, and its withdrawal from these in the products of agriculture, and subsequent concretion into the bones of animals, as the cause of sterility. He refers to countries once abundant in cereal products and teeming in population, such as Sicily and Syria, as owing their present desolation to the abstraction of phosphoric acid by the products of the surface soil, which acid subsequently enters into the bony frames of animals. The bones of man are buried deep under ground, beyond the reach of growing plants, whilst those of the inferior animals are scattered far away from the places where they were formed. He even makes a calculation of the number of tons of phosphoric acid removed from the soil of France, since the period when its lands were wrested from the rude Celts, and subjected to civilization and culture. The grand result which he arrives at is, that the amount is not less than two millions of tons of phosphate of lime, drawn from the soil in its surface products, and concreted into human bones.

The revelations of science in the laboratory have been well tested

in the field, and perhaps by no one in this country on a scale so extensive as by myself, having for many years past applied from thirty to forty tons a year of concentrated fertilizers abounding in phosphates, on farms which I cultivate, in Kent County, Delaware. These were in a very impoverished condition when I began to apply concentrated fertilizers, the bases of which are phosphates of lime. The particular preparation I use has the bone-earth brought into a soluble state by chemical agency. The soluble phosphate has a sufficient amount of ammonia, with other fertilizing elements, to meet all the requisitions of growing plants in every stage of their development. By such applications I have obtained results in the highest degree satisfactory, in proof of which, I am able to state that in from two to four years' time, I have brought up land so as to yield three and four times what it could do before the applications were made. The increase in the crops always paid for the outlay in the fertilizer, and thus the increase in the productive value of the land was clear gain. To state one out of many cases tried (some on a much larger scale), a small farm of about one hundred and ten arable acres, was dressed with a good ammoniated superphosphate applied in the successive crops during two years. In its former greatly impoverished condition, it would pay less than $150 per year, or an interest on $2500. At the end of two years, after an outlay of about $800 in the fertilizer, the farm was permanently improved so as to yield a rent of $600, thus showing that the productive value had been raised from $2500 to $10,000.

My extensive use for many years past, of a fertilizer in which soluble phosphate or superphosphate of lime constitutes the basis, has fully established the views taken by scientific men, of the inestimable value of phosphoric acid to increase the productiveness of the soil.

I reckon my agricultural profits as mainly based upon my ability to supply the land with the necessary amount of soluble phosphoric acid. This when once removed is never supplied from natural sources, and consequently, has to be put back by the hand of man. Not so with other fertilizing elements, which, like ammonia, is derived from the atmosphere, whilst the alkaline earths are often supplied by the disintegration of minerals composing the soil. Whilst the farmer rejoices in having obtained the power to derive treble and quadruple profits from his labor, he must bear in mind that for this power, he is under obligations to the brilliant results of scientific investigation.

Various practical questions were put to Dr. Emerson by the members present, to which he replied.

Mr. Foulke referred to the interesting fact, that the presence of phosphorus seems to be a *sine qua non* to life in all its phases, from the thought-life of the brain of man down to the simplest cell-life of the infusorial world.

Dr. Goodwin referred to previous discussions of the subject of the Freedom of the Will, and spoke in proof both of the existence of the faculty and of its freedom.

Mr. Foulke considered the discussion as exhausted long ago by President Edwards, and unserviceable in a day of natural science.

Mr. Lesley advocated the discussion of metaphysical subjects as a philosophic necessity, but urged the harm of a merely logical play with words which have descended to us from a remote antiquity, clothing themselves with traditional meanings on their way.

In this instance an ancient elliptical expression, originally standing for an act or at most for an affection of the soul, was afterwards personified as a power, and has at last entered our philosophical creed as an essence. We discover in the most ancient languages no aboriginal word for will, with a meaning such as the modern bears. There are only words meaning Desire, Intention, Power governmental, Power judicial, Verdict, an attitude of the Soul as an active unit in presence of the surrounding world. Nor have we any direct evidence of the existence of a separate faculty called Will. As to the supposed conflict between the two theories of the determined and self-determining Will, in other words between Free Will and Necessity, it is likely to disappear with the disappearance of the supposed faculty. And in any case, testimony being taken on both sides by Natural History methods, both the freedom of man's responsible soul and its absolute subjection to motives are alike affirmed; nor does there seem to be any rational necessity in deciding for the one, for rejecting the other.

The minutes of the last meeting of the board of officers and members in council were read with the list of nominations recommended.

Mr. Foulke moved that the Committee on the Arctic Expedition under the command of Dr. I. I. Hayes, be requested to invite Dr. Hayes to be present at the next meeting of the

Society, and to give such information as he may deem important in relation to the scientific results of the Expedition. Seconded by Dr. Bache, and the motion was agreed to.

A letter of the President, Dr. Wood, to the Honorable Cassius M. Clay, Minister of the United States at the Court of St. Petersburg, was then read.

And the Society was adjourned.

Stated Meeting, December 6, 1861.

Present, thirty-four members.

Judge SHARSWOOD, Vice-President, in the Chair.

A letter was read from the President, Dr. Wood, dated Breslau, November 4, 1861.

Donations for the Library were announced from the Bureau des Ponts et Chaussées, the London Chemical and Royal Astronomical Societies, the Essex Institute, the American Journal of Science, and Professor Twining, of New Haven, the Medical News, the Academy of Natural Sciences, Professor Trego and Mr. H. C. Carey, of Philadelphia, citizens of Chicago, and booksellers in London and New York.

The committee appointed by the American Philosophical Society in relation to an invitation to Dr. Isaac I. Hayes, reported that they addressed to Dr. Hayes a note, of which the following is a copy:

HALL OF THE AMERICAN PHILOSOPHICAL SOCIETY,
PHILADELPHIA, November 16, 1861.

SIR:

The undersigned, a Committee of the American Philosophical Society, have the pleasure of communicating to you the following resolution of that Society, unanimously adopted at a meeting held on the 15th instant.

"Resolved, that the Committee on the Arctic Expedition, under the command of Dr. Isaac I. Hayes, be requested to invite Dr. Hayes to be present at the next meeting of the Society, and to give such

information as he may deem important in relation to the scientific results of the expedition."

The next meeting of the Society will be held in its Hall at eight o'clock P.M., on the first Friday of December next.

The undersigned express their hope that it will accord with your convenience to comply with the Society's request.

We are, very respectfully,

Your obedient servants,

(Signed) W. PARKER FOULKE,
JOHN C. CRESSON,
ISAAC LEA,
JOHN L. LECONTE,
EDWARD KING,
R. E. ROGERS,
J. PETER LESLEY.

To DR. ISAAC I. HAYES,
Commander of the late American Arctic Expedition.

Your committee received the following reply:

PHILADELPHIA, December 3, 1861.

GENTLEMEN:

I have just received your letter dated the 16th ult., informing me that the American Philosophical Society had done me the honor of inviting me to attend the next meeting of the Society, and to communicate such information as I might deem important respecting the scientific results of my expedition.

It will give me much pleasure to comply with the wish of the Society. I am, gentlemen,

Very respectfully, your obedient servant,

(Signed) I. I. HAYES.

To Messrs. W. PARKER FOULKE,
JOHN C. CRESSON,
ISAAC LEA,
JOHN L. LECONTE,
EDWARD KING,
R. E. ROGERS,
J. PETER LESLEY,
Committee of the American Philosophical Society.

All of which is respectfully submitted.

W. PARKER FOULKE,
Chairman.

Dr. Hayes was then introduced to the Society, and communicated to the members present some of the historical incidents and scientific results of the voyage.

MR. PRESIDENT,—GENTLEMEN:

I feel much honored by your invitation to attend your meeting this evening, and to communicate some of the results of my late expedition.

Such an invitation from the oldest and most prominent scientific association in this country, imposes upon me a duty which is at once peremptory, and highly gratifying to me. Yet I cannot but remember, that I appear before those whose studies have obtained for them a merited distinction in every department of learning for the benefit of which the expedition was designed. The names of many of you had become illustrious, even in foreign countries, long before I was of an age for the study of a profession. Scarcely had a diploma been given to me as a Doctor in the Medical Art, when I sailed, in 1853, with the late Dr. Kane, as surgeon of his Expedition; and I remained in that service until late in the year 1855. Although thus deprived of many of the opportunities for general scientific study which would have been available at home, yet the necessities of the Expedition threw upon me a share of every duty, whether appertaining to the various scientific observations, or to the conduct of exploring parties. Upon my return to the United States, I formed the plan of another expedition. There were many circumstances of discouragement, not least among which was an impression which then had possession of the public judgment, that any further efforts toward the North Pole must be fruitless, and must involve an unjustifiable loss of life. It was only after many endeavors that here and there the influences favorable to my design began to affect the community. The most important of these was, of course, the sanction given to my plans by those associations by whose opinions the mass of men are governed in relation to scientific matters; and it gives me pleasure that I am to-night, enabled, personally, to thank you for the encouragement and aid which were afforded by your formal appointment of a committee to co-operate with me.

To this approval of your Society, so widely known and respected, were added that of the Academy of Natural Sciences of this city, the Smithsonian Institution, the American Association for the Advancement of Science, the Geographical Society of New York, the principal scientific associations of Boston, and the private assurances of many learned individuals.

Little time was left me for special preparatory study. Mr. Sonntag, the able astronomer and physicist of Dr. Kane's Expedition, volunteered to assume the same duties during my own, and also to aid me as second in command; and upon him were to be devolved the most important of the observations. His death soon after entering our winter quarters left me with the aid only of three young men, who were dependent, almost wholly, upon my instruction and supervision.

I have made these explanations in order that you may the better appreciate the difficulties which embarrassed us, and that, accustomed as you are to the most complete scientific labors, you may not be induced in advance to overrate the unpretending collections made during my cruise; yet it is due to the truth to say, also, that notwithstanding these difficulties, the zealous aid of my young assistants has enabled me to return with some valuable additions to our previous stores of knowledge.

You may recollect that my outfit was a very small one. Upon leaving Boston, July 10th, 1860, my entire party numbered only fifteen persons, and we sailed in a schooner of only one hundred and thirty-three tons burden. My purpose was to follow up the line of research opened by Dr. Kane. I allude, of course, to that of Smith Strait and Kennedy Channel. You will readily understand that I had no such idle purpose as was sometimes popularly attributed to me, viz., that of merely reaching the North Pole of the earth, as a feat of adventurous navigation and sledging.

The general object was to procure as much information as the restrictions of our voyage would allow, beyond the termination of Dr. Kane's labors, and in the same direction in which they tended. The space between the point at which his personal observations ended and the North Pole, is about six hundred and fifty miles, an interval sufficiently large to admit of very numerous and important collections.

Coinciding with him in the opinion that at some portion of each year there exists a large body of water about or near the Pole, I hoped to extend the evidence which he had collected on this subject as well as on many others.

It would, of course, have been a source of the highest satisfaction to have succeeded in setting at rest the question of open water, but it was by no means the sole object of the Expedition.

I will not dwell upon the details of our voyage to Greenland, which was unusually boisterous. The schooner was unavoidably so heavily laden that her deck was never more than eighteen inches

above the water, and was never dry. After touching at Pröven and Upernavik, we reached, on the 21st of August, Tessuissak, the most northern of the Danish stations, in latitude 73° 40′. At all of these places we were kindly received, and the officials furnished me with every facility in their power for procuring the requisite furs and dogs for sledge travelling.

Our route lay thence northward through Melville Bay, the general track of the whalers. Beyond the parallel of the Carey Islands, near which the whalers annually pass, and thence to Smith Strait, our track was the same as that of Dr. Kane. The distance from the northern limit of the whale fishery to Smith Strait, you will perceive, is not great; and with a fair wind we ran it in a few hours. The chief interest of our voyage commences, therefore, on the 26th of August, on which day we were a little to the northward of the position of Baffin in 1616, and Ross in 1818, twenty miles south of Cape Alexander, the entering cape on the Greenland side of Smith Strait.

The Strait was entered on the 27th of August; but we were unfortunate in meeting near its mouth an ice-pack of extraordinary thickness, through which no passage could be effected. This pack trended off to the south and west, and appeared to adhere to the western coast. Our efforts to find a navigable lead were interrupted by a heavy gale, which broke suddenly upon us, and drove us out of the Strait. The gale continued with great force for three days, during which we were a second time driven out of the Strait, and, having at length sustained serious damage, we made the land and anchored.

At that place I went on shore, and from an elevation of twelve hundred feet, obtained a view to the west and north. The ice was everywhere closely packed and heavy. On the following day, we were blown from our anchorage, and were much damaged against some icebergs which had drifted in with the current. It was as late as the 1st of September that we again entered the Strait, again to be blown out and crippled by a sudden return of the gale. It was not until the evening of September 2d that we effected a permanent lodgement in the Strait. Failing to find an opening toward the west shore, I determined to seek one higher up near Cape Hatherton; but, when among the ice off Littleton Island, the schooner became "beset," the iron sheathing on the bows and the cutwater was carried away, and the rudder was rendered useless. After some hours we reached a place of safety and anchored. We put to sea

again on the 6th; but, failing to pass Littleton Island, and the temperature having fallen to 12°, when navigation was no longer safe, I was obliged to go into winter quarters in Hartstein Bay, ten miles northeast of Cape Alexander, in a harbor which I have named Port Foulke, in honor of my friend, William Parker Foulke, Esq., of Philadelphia, a member of this Society, who was the earliest and has been one of the most constant friends of the Expedition. Subsequent observations gave our position latitude 78° 17′ 41″, longitude 72° 30′ 57″ W., twenty miles south of the latitude of Rensselaer Harbor (Dr. Kane's winter quarters), and distant from it by the coast line about ninety miles.

At the time of going into winter quarters my vessel was badly crippled by frequent collisions with field ice, and by twice being driven upon icebergs. The weather was not only very boisterous from the time of our first entering the Strait, but thick snow was almost continually falling. I regretted very much that I had not steam-power.

My plans of exploration being based upon reaching the west coast and there attaining a harbor above or near latitude 79°, which I had thought practicable from personal observations made in 1854, you will perceive that my winter harbor was very unfavorable for the accomplishment of my purpose. I could not attain even as convenient a position as that of Dr. Kane, whose line of travel being near the Greenland coast was freed from some of the obstacles attending my passage across the Strait, with dog sledge, to Grinnell Land.

Our preparations for the winter were similar to those of Dr. Kane. A house was built on shore to receive our stores, and the hold of the vessel was converted into a room for the men. The upper deck was covered with a house made of boards which had been brought for the purpose. The ship's company lived in health and comfort.

With the winter, however, came serious misfortunes. A disease which has been for several years prevailing throughout all Northern Greenland, broke out among my dogs, and by the middle of December all of them had died but eleven. It became then necessary to open communication with the Esquimaux of Whale Sound, with the view of obtaining a new supply. It will be remembered that my plans of exploration were based entirely upon the use of dogs as a means of transporation across the ice; and from my unfavorable situation it appeared evident that with my reduced force I had not the means to prosecute my purposes with the success which I had anticipated.

Mr. Sonntag early volunteered to go to the Esquimaux for the pur-

pose before named. His offer was accepted, and he started on the 22d of December, with a sledge drawn by nine dogs, and accompanied by Hans (Dr. Kane's young native hunter), whom I had found at Cape York. Mr. Sonntag lost his life in attempting to cross Whale Sound, under the following melancholy circumstances, as reported to me by Hans upon his return. In attempting to cross a crack which had been recently frozen over, Mr. Sonntag broke through the thin ice and became thoroughly wetted. He was assisted out of the water by his companion, but before they could reach a place of shelter, five miles distant, Mr. Sonntag was so badly frozen that he was insensible, and he died soon afterwards. The body was subsequently recovered and interred near the observatory at Port Foulke.

Hans continued southward and accomplished one of the purposes of the journey; but, in consequence of bad management and over driving, five dogs of his team were killed, and I was left, upon his return, with only six animals. The Esquimaux having learned through Hans of our being at Port Foulke, came to us in the spring, and from them I was enabled to obtain a sufficient number of dogs to increase my pack to about twenty animals; but some of them died afterwards, and I was left, finally, with two teams of seven each. With so reduced a force, I became seriously apprehensive for the success of the labors which were to follow.

On the 20th of March, I set out on my first journey. The object of this effort was to establish a provision depot for use during the summer, and it was successful. While absent upon this occasion I visited Rensselaer harbor, Dr. Kane's winter quarters. No vestige of the "Advance" could be discovered. She has probably drifted out to sea with the ice, and been subsequently crushed and sunk.

The preparations for the principal journey were completed early in April; and on the 4th of that month I started northward with my entire available force, comprising twelve men and fourteen dogs. Our equipment consisted of a metallic lifeboat mounted on runners, provisions for seven persons for five months, provisions for six persons and fourteen dogs for six weeks, and the necessary camp fixtures.

That part of my plan involving the transportation of the boat to Kennedy Channel proved, after three weeks' trial, to be impracticable, and I accordingly sent the main party back, and continued northward with the two dog-sledges and three companions. After a journey beset with unusual difficulties, the west coast was reached on the 10th of May, and I continued thence northward along that coast

until May 18th, when my provisions being exhausted I was obliged to return. We had then reached latitude 81° 35′. During the last few days of my northward journey, I was, in consequence of the severe labor having broken down the other members of my party, accompanied only by a young Philadelphian, Mr. George F. Knorr, who served with great fidelity and spirit throughout the Expedition.

The schooner was broken out of the ice on the 10th of July, and we put to sea on the 14th. After much difficulty and two trials, we reached the west coast, ten miles below Cape Isabella. That cape I was unable to pass in the vessel, but I succeeded in making its north side in a whale-boat, and from an elevation of about six hundred feet, I obtained a view to the northward. In that direction the ice was everywhere unbroken; and as it did not appear probable that I could obtain for the schooner a more northern harbor, and as I had now only five dogs remaining, I abandoned the field and returned home, trusting to be able at an early day, to renew the attempt with a small steamer.

We reached Upernavik on the 14th of August, and Godhavn, Disco Island, September 1st. At both of these places, we were kindly and hospitably received by the Danish officials. At the latter place, I had the satisfaction to meet the Royal Inspector, Mr. Olrik, an honorary member of this Society. Upon reaching Godhavn, I was kindly informed by Inspector Olrik that he had received orders from his Government, framed in accordance with a request made by the Government of the United States, directing him to afford such aid to the Expedition as was in his power; and it gives me great pleasure to be able, on an occasion like the present, to acknowledge the important services rendered to the Expedition by the Danish Government, and its officials in Greenland—exhibiting that characteristic generosity and intelligent appreciation, which have uniformly marked their actions towards all previous explorations of a similar nature.

Our voyage from Godhavn southward was very stormy, and when off Halifax, such damages were suffered as required us to put into that port for repairs. Our welcome there was very cordial and highly grateful to us. The Admiral of Her Britannic Majesty's fleet, then in Halifax harbor, generously tendered the use of the Government conveniences for repairing my crippled vessel. To the officers of Her Majesty's civil government, and of the squadron and garrison, and to the citizens of Halifax, the Expedition is indebted for attentions which exhibited not less a friendly feeling for men who had for so long a time been deprived of many of the comforts of

civilization, than respect for the flag under which our explorations had been made.

Having sailed from Boston, I considered that a proper respect for those who gave me the vessel required that I should return to that port. Leaving Halifax on the 19th of October, we arrived in Boston on the 23d, after an absence of fifteen months and thirteen days.

I have dwelt thus at length upon the narrative of the Expedition, in order that you may have a clear understanding of the region covered by it. I will now pass to a brief statement of the results of our labors.

Soon after entering our winter harbor, an observatory was erected upon shore near the vessel, under the superintendence of Mr. Sonntag. It was a frame structure, covered first with canvas and then with snow, and was eight feet square. In this, a fine pendulum apparatus, constructed under Mr. Sonntag's supervision, by the Messrs. Bond of Boston, after the plan of Foster's instrument, was immediately mounted; and satisfactory sets of experiments were then obtained by Mr. Sonntag, assisted by Mr. Radcliff. The pendulum beat nearly seconds; that is, rudely, 3607 beats in 3600 seconds of time. The readings were made when the knife-edge passed the zero point of the graduated arc. The interval of the readings was ten seconds, and eleven readings generally made a set. These observations were continued from September 26th until October 12th. They are yet unreduced, and I am therefore unable to announce to what conclusions they lead. I may mention that experiments were made by Mr. Sonntag and Professor Bond at the Cambridge Observatory, prior to the sailing of the Expedition; and that the instrument will be placed in Professor Bond's hands, for a repetition of the experiments at the same place.

Upon removing the pendulum apparatus, a fine unifiliar magnetometer was mounted upon a firm support in the centre of the observatory, and the scale readings were recorded hourly every seventh day, and three times daily during the interval, from November to March. The same instrument was subsequently used for obtaining several sets of experiments in declination, deflection, and vibration. A corresponding number of sets of experiments for the determination of dip were also made with a well-adjusted instrument. These latter four classes of observations were, with certain omissions, subsequently repeated at Cape Isabella on the west side of Smith Strait, at Netlik in Whale Sound, at Upernavik, and at Godhavn. All of these observations are yet unreduced. I may mention that the instru-

ments were furnished to the Expedition by Professor Bache, Superintendent of the United States Coast Survey, under whose supervision the constants had been carefully determined, and to whom the instruments will be returned for correction.

Near the observatory, a suitable shelter was erected for a number of thermometers, which were read hourly every seventh day, and three times daily in the interval. These instruments were carefully compared at every 10° of temperature down to —40°, and these records were referred to a standard which was brought home, and has been placed in the hands of the maker, Mr. Tagliabue, for further comparison. Some of the instruments were manufactured by Mr. Green, of New York, and were a gift from the Smithsonian Institution. The remainder were presented by Mr. Tagliabue. These observations were continued during our stay at Port Foulke, from September, 1860, to July, 1861.

Throughout the cruise, a bi-hourly registry of atmospheric temperature was made with a single instrument, mounted on the vessel when at sea, and on a post upon the ice when in winter harbor. A like number of barometer readings was also made and recorded. A careful record of meteorological phenomena, including direction and force of wind, and general atmospheric conditions, was kept up during the cruise.

Although there has been no discussion made of these observations, yet there are some manifest general results which may interest you. Our winter was much milder than either of the winters 1853–54 and 1854–55, passed by Dr. Kane at Rensselaer Harbor, twenty miles further north. The weather was, unlike that experienced by Dr. Kane, generally stormy. Northeast winds, frequently very strong, prevailed—a fact at least in part, accounted for by the open water which was, during our stay at Port Foulke, constantly visible outside of the harbor; and it was, doubtless, due to the same fact, that we experienced a modification of temperature. March was the coldest month. It was during this month, and while absent at Rensselaer Harbor, that I recorded my lowest temperature, —68° F. It is remarkable that on the same day, the lowest temperature registered at Port Foulke was only —29°, and on the day previous, when I experienced a temperature of —66.5° near Rensselaer Harbor, the temperature at Port Foulke was —27°.

I have made at Port Foulke a valuable set of tidal observations, which will, when reduced, exhibit some interesting results. The average rise and fall was about eight feet. The readings were made

to tenths of a foot, and at intervals of ten minutes. While at sea the temperature of the surface water was registered bi-hourly. I had frequent occasion to regret that I did not have a deep-sea sounding apparatus; for the furnishing of which, through a misapprehension, I had relied upon the National Observatory.

Geological and mineralogical collections have been brought from Port Foulke and vicinity, and from the west coasts of Smith Strait and Kennedy Channel. A few fossils were found in the limestone rocks of Capes Leidy and Frazer, and at other points of the coast of Kennedy Channel, north of latitude 80°. The difficulty of carrying geological specimens so great a distance upon a dog-sledge will be appreciated by the Society.

Our collections of specimens of natural history are extensive. They embrace dredgings from various points along the Greenland coast between Godhavn and Port Foulke, plants from all the localities visited, skins and skeletons of the principal mammals, skins of most of the arctic birds, and a large number of skulls of Esquimaux. The reindeer were very numerous at Port Foulke. Upwards of two hundred of them were shot by my party. The walrus, and seal of different varieties, were also abundant. During the summer several varieties of waterfowl frequented localities about our harbor. The most numerous of these were the little auk (*Uria alle*) and the eider duck (*Somateria molissima*), several hundreds of which were captured. From these sources I had no difficulty in constantly supplying my party with fresh food; and to this I attribute in a great measure our entire exemption from disease.

The geographical results of the Expedition embrace a survey of the west coast lines of North Baffin Bay, Smith Strait, and Kennedy Channel, including the discovery of a new channel or sound, opening westward from the centre of Smith Strait. This survey was made without reference to previous charts. It commences at latitude 76° 30′, and extends north to latitude 82° 40′, embracing a shore-line of about 1300 miles. I regret that I was not able to cross over to the eastern coast of Kennedy Channel, and, therefore, had no opportunity to confirm the observations of the sailor Morton, who, you will remember, was the person who reported to Dr. Kane the existence of open water in Kennedy Channel in June, 1854; also an eastern coast line of that channel as far as latitude 80° 56′; beyond which point the party could not penetrate in consequence of the open water.

In 1854, while acting under the orders of Dr. Kane, I had made

a survey of that portion of the west coast of Smith Strait lying between capes Sabine and Frazer, but the unfavorable circumstances of that survey had occasioned some errors which I am glad to have had opportunity to ascertain and correct.

Our further geographical results embrace the completion of the survey of the coast lines of Whale Sound, and the re-survey of all the coasts between Wolstenholme Sound and Littleton Island. In that survey is embraced a shore-line of about 600 miles. Of the five islands laid down on Captain Inglefield's and Dr. Kane's charts, as being in the mouth of Whale Sound, we could find only three.

In physical geography I have obtained some interesting materials. Soon after entering winter harbor, I made, in connection with Mr. Sonntag, a survey of a glacier which approaches the sea through a valley opening from the head of the bay in which we wintered. This had been discovered by Dr. Kane, and by him named My Brother John's Glacier. Its face is nearly two miles from the sea, which it is gradually approaching. With the view of determining its rate of progress, we ascended to its upper surface and carefully measured a base-line in its axis. From either end of this base-line angles were taken, connecting it with fixed objects upon the mountains on each side. Lateral stations were next established, and these were connected with the base-line, and with the before-mentioned fixed objects. The angles were repeated by me after an interval of eight months, and the result showed a downward movement of the glacier, amounting to ninety-four feet.

In October I performed a journey upon this glacier and the *mer de glace* to the eastward of it, penetrating about fifty miles into the interior. Our angle of ascent was, at first, about six degrees, decreasing gradually to from one to two degrees. The surface was at first somewhat broken and irregular, but as we advanced it became smooth and the ascent regular. Our elevation upon setting out to return was estimated at about 5000 feet, when we were quite out of sight of land.

The physical conditions observed in Kennedy Channel are, perhaps, among the most important of my results. It was in that channel, and to the northward of it, as I have before observed, that Morton discovered an open sea late in June, 1854. I did not find open water, but the ice was everywhere much decayed, often being so thin that it would not bear my party; and in some places pools of water were visible. In one of these pools a flock of waterfowl, the *Uria grylle*, were observed. My stay in Kennedy Channel was from the 12th

to the 23d of May, a period of the year six weeks earlier than that at which the observations of Morton had been made; and I entertain no doubt that, could I have returned to the same locality in the latter part of June, I would have found the sea open. Indeed, everything indicated a speedy dissolution of the ice. There were some indications also that the region to the northward is annually open. I will mention one which struck me most prominently. The coast on the west side of Kennedy Channel, especially where exposed to the northeast, was lined with a heavy ridge of ice, which had been forced up under the influence of great pressure. Many of the masses were as much as sixty feet in height, and they were lying high and dry upon the beach. The pressure necessary to occasion this result could not possibly be created by ice-fields moving over a narrow channel, and I believe the result to have been produced by ice-fields of great extent coming down under the influence of winds and the current from a vast open area to the northward.

Our astronomical observations were chiefly confined to the determination of geographical positions.

I observe that there are some gentlemen present who had a kindly interest in my design of attempting to make photographs of arctic scenery and other objects, and I may mention that I have been in a great measure successful. I was disappointed in not obtaining the photographer whom I had hoped to take with me, and I was therefore obliged, without any previous knowledge of more than the principles of the art, to do the work myself. I was assisted by Mr. Radcliff, who was equally ignorant. We, however, succeeded, after many failures, in obtaining some good pictures, and a large number of inferior ones. There are no physical difficulties in the way of the most complete success.

In conclusion, Mr. President, I desire to renew my thanks to the Society for their great courtesy and for the honor which has been done me.

On motion of Professor Cresson, the thanks of the Society were presented to Dr. Hayes, for his interesting and instructive communication made to the Society this evening.

A letter from Joseph Paxton, deceased, to David Paul Brown, was read, dated Catawissa, November 22, 1861, noting the fact that a larva had been found in the old leg of a bench, where it had remained alive for more than twenty-six years.

The annual report of the Treasurer was read and referred.

The annual report of the Committee on Publication was read.

Pending nominations Nos. 425 to 443 and new nomination No. 444 were read.

And the Society was adjourned.

Stated Meeting, December 20, 1861.

Present, sixteen members.

Judge SHARSWOOD, Vice-President, in the Chair.

Donations for the Library were received from Professor Secchi, of Rome, the Boston Natural Historical Society, the General Association of Connecticut, the Massachusetts Historical Society, the Regents of the New York University, the Franklin Institute, the Rev. A. Crummell, Dr. Genth, and T. W. Reeves.

Judge Carleton communicated to the Society some ideas on the formation of opinion, as having analogy with his previous remarks before the Society on Liberty and Necessity.

Remarks upon the subject, and upon the views of Judge Carleton were made by Dr. Goodwin, who expressed his reasons for dissenting from some of the opinions advanced by the former speaker.

Judge Carleton replied, and made some further observations in support of his opinions with regard to Free Will, Motive, and Consciousness.

Professor Lesley followed with some remarks, explanatory of his views expressed at a former meeting.

Mr. Peale laid before the meeting certain stone implements from Ireland and Scandinavia, showing a remarkable similarity with those of the North American Indians.

The Committee of Finance reported the following recommendations for the ensuing year, which were accordingly on motion ordered.

For Journals,	$50 00	
Hall,	100 00	
Binding,	100 00	
Publications in addition to the interest on the publication fund,	800 00	
General account as follows:		
Salary of Librarian,	$700 00	
" Janitor,	100 00	
Insurance of Library and Cabinet,	160 00	
Assistance to Librarian,	350 00	
Petty expenses of Librarian,	50 00	
		$2410 00
Commissions on collections, indexing and arranging Franklin Papers, postages, and all other incidental and general expenses,		800 00
		$3210 00

Pending nominations Nos. 425 to 444 and new nomination No. 445 were read.

And the Society was adjourned.

DONATIONS FOR THE LIBRARY,

IN 1861.

FROM CORRESPONDING SOCIETIES, ETC.

St. Petersburg.

Mémoires de divers savants. Tome IX, 4°, 1859.

Mémoires politiques, &c. VI Ser. Tome IX, 4°, 1859.

Mémoires mathematiques, &c. Tome IX, 4°, 1859, X, 4°, 1859.

Mémoires. Tome II, III, as follows: Nos. 4, 5, 6, 7, 1.

Bulletin. Feuilles 1–17. 4°, 1860.

Annales de l'Observatoire physique central de Russie. Année 1857. No. 1. St. Petersburg. 1860. 4°.

Compte rendu for 1857, No. 2, 1860. 4°. St. Petersburg.

Recherches expérimentales sur l'élasticité des métaux, faites à l'Obs par A. T. Kupffer. T. I. St. Pet. 1860. 4°. 429 pp.

Riga.

Correspondenzblatt des Naturforschenden Vereins. 1859. 8°.

Königsberg.

Schriften der k. Phys. Oekon. G. I. J. 1 abt. 4°. 1860.

Die metamorphose des Caryoborus. Elditt. 1860. 12 pp.

Berlin.

Abhandlungen der k. Akademie. 1859–60. 4°.

Monatsberichte, aus 1860. 8°.

Register für 1836–1858 monatsberichte. 8°.

Wochenschrift des Vereins zur beförderung des Gartenbaues. Nos. 14 to 52, 1860; 1 to 6, 1861. 4°.

Göttingen.

Nachrichten von dem G. A. Un. und K. G. der W. 1860, Nos. 1–29, rebst Register.

Offenbach a. Maine.

Erster Bericht des Off. Vereins für Naturkunde. 1860. 8°.

Bonn.

Verhandlungen des N. V. der P. R. u. W. XVII, J. i–xxv. 8°.

Altenburg.

Mittheilungen aus dem Osterlande. XIV, 1, 2, 3, 4; XV, 1, 2.

Elberfield und Barmen.

Jahresbericht des Naturwiss. Vereins. 1851, '3, '8. 1–3 heften, 8°.

Bamberg.

Bericht des Naturforschenden Vereins. 1852, 1854, 1856, 1859.

Vienna.

Sitzungsberichte der Akademie: Philosophisch-historische classe. XXXIV B. 1, 2, 3; XXXV, 1, 2, 3, 4 heften to Nov. 1860.

Mathematisch-naturwissenschaftliche classe. XXXIX B. No. 6; XL, 9, 10, 12; XLI, 13 to 20; XLII, 21 to 28.

Almanach X. J. 1860. 12°.

Jahrbuch der k. k. Geologischen Reichsanstalt. 1860. XI. No. 1.

Verhandlungen des Zool. Botan. Vereins. Vols. III to X, 1853 to 1860. 8°.

Munich.

Sitzungsberichte der k. Bay. Ak. d. Wiss. i, ii, iii, 1860. 8°.

Abhandlungen. Math. phys. C. VIII. B. iii. 4°.

Verzeichniss der Mitglieder für 1860. 4°.

Grenzen und grenzgebiete der physiologischen forschung. E. Harless. 1860. 4°.

Von der bedeutung der Sanskritstudien für die Griechische philologie. W. Christ. 1860. 4°.

Rede auf Sir T. B. Macaulay. G. T. Von Rudhart. 1860.

Denkrede auf A. Von Humboldt. Von Martius. 1860. 4°.

Gelehrte Anzeigen. B. 49, 50. 4°.

Stockholm.

Handlingar k. S. Vetenskaps-Akademiens. Ny följd. 1858. 4°.

Ofversigt af k. V. Akad. förhandlingar. 1859. 8°.

Meteorologiska iaktagelser . . . k. S. V. Akad. 1859. Long 4°.

Eugenies Resa. Zool. IV. 4°. 222–298 pp.

Copenhagen.

Oversigt k. D. V. S. Forhandlenger. 1859. Forchhammer. 8°.

Haarlem.

Extrait du programme de la Société Hollandaise. 1861. 4 sheets, 4°.

Geneva.

Archives de l'electricité, par M. A. De la Rive. Supplement à la Bibliothèque Universelle de Genève. Tome I. Année 1841. II, Nos. 4, 5, 1842, 2 parts. III, Nos. 6, 7, 8, 9, 10, 11, 12, 1843, 6 parts. IV, Nos. 13, 14, 15, 16, 1844, 4 parts. V, Nos. 17, 18, 19, 20, 1845, 4 parts.

Bibliothèque Universelle de Genève et Archives des Sciences Physiques et Naturelles. Quatrième série. 1 année. No. 1, 15 Feb. 1846, and so on, 12 numbers for 1846, making, say, 4 vols. Wanting 1847. 12 numbers for 1848, 2 vols. 9 numbers (wanting Feb., March, April) 1849, 2 vols. 11 numbers (wanting July) 1850, 2 vols. 12 numbers 1851, 2 vols. 10 numbers (wanting Oct., Nov.) 1852, 2 vols. Nos. 42, 43, June, July, 1861, 2 vols. Presented by J. C. Cresson. T. X. No. 39, No. 44.

Rome.

Memorie dell' Observatorio dell Collegio Romano D. C. D. G. Nuova serie dall' anno 1857 al 1859. Roma. 4°.

Cadiz.

Almanaque Náutico para 1862 calculado en al Observatorio de Marina de la ciudad de San Fernando. 1 vol. 1860. 8°.

Paris.

Bulletin de la Soc. de Geog. 4 Sér. T. XX. 1860.

Annales des Mines. Tome XVII, 2e, 3e liv. de 1860; XVIII, 4e, 5e, 6e liv. de 1860, 1e, 2e liv. de 1861.

Faune primordiale dans la chaine Cantabrique, par M. M. Casiano De Prado. 2e serie. Tome XVII. 1860. 8°.

Les libre échangistes et les protectionnistes conciliés, ou solution complète des principales questions économiques, par M. Du Mesnil Marigny. Paris, 1860. 8°.

Richesse des Nations, Theorie de M. Du Mesnil Marigny, . . . et response de l'auteur. 1861. pam. 8°.

Tables des Comptes Rendus. Deuxième semestre, 1849. Tome XXIX, pam. 4°. (From J. C. Cresson.)

Brussels.

Royaume de Belgique. Doc. Stat. T. II, 1858, III, 1859. 4°.

London.

Royal Society. Proceedings, Vol. X, 40, 41; XI, 42, 43.

Royal Institution. Part X, Nov. 1859 to July 1860. 8°.

List of members for 1859. 8°. London, 1860.

On the Origin of the Parallel Roads of Lochaber (Glen Roy). pam. 5 pp.

Royal Astronomical Society; Monthly notices. Vol. XXI, Nos. 1, 2, 3, 1860, Nos. 4, 5, 6, 7, 8, 9, 1861.

Journal of Royal Geographical Society. Vol. XXX. 8°. 1860.

Proceedings. Vol. IV, No. 5. 8°. 1860. Vol. V, Nos. 1, 2, 1861.

Anniversary Address, May 28, 1860, by Earl de Gray and Ripon. Vol. IV, No. 4. 8°.

Quarterly Journal of the Chemical Society, Vol. XIII, No 4. 8°. Vol. XIV, 53, 54, 55, 1861.

Quarterly Journal of the Geological Society. 8°. Vol. XIII, No. 49. 1857. Part 1. Annual address, Feb. 20, 1857. Col. J. E. Portlock. Vol. XIII, No. 52, Part 4. Vol. XIV, Nos. 54, 55, 56, May, Aug., Nov., 1858, Parts 2, 3, 4. Vol. XV, Nos. 57, 58, 59, 60, 60*, Feb., May, Aug., Nov., 1859, Feb., 1860, Parts 1, 2, 3, 4, 5, supplement. Vol. XVI, Nos. 61, 62, 63, 64, Feb., May, Aug., Nov., 1860, Parts 1, 2, 3, 4. List of the Geological Society of London, Sept. 1, 1860, 8°, 32 pp. Vol. XVII, No. 65, Feb., 1861, Part 1.

Proceedings of the scientific meetings of the Zoological Society of London, June, 1860, Part 3, to March, 1861, Part 1. 8°.

Journal of the Royal Asiatic Society of Great Britain and Ireland, Vol. XVIII, Part 2. London, 1861. 8°.

Journal of the Society of Arts and of the Institutions in Union, Vol. VIII, Nos. 402 to 440. 8°. 1861.

Catalogue of reprints and fac similes illustrative of early English and Shakspearian literature. Sotheby and Wilkinson. Lond. 1861.

Edinburgh.

Proceedings of Royal Society of Edinburgh, session 1859–60. 8°.

Transactions, Vol. XXII, Part 2, for the same session. 4°.

Appendix to the Makerstoun Magnetical and Meteorological Obs., being a supplement to Vol. XXII of the Transactions of the Royal Society of Edinburgh. 1860. 4°. (Unbound.)

Oxford.

The Radcliff catalogue of 6317 stars. 8°. 1860.

Dublin.

Journal of the Royal Dublin Society, Nos. XVIII, XIX, 1860.

Journal of the Dublin Geological Society, Vol. VII, i, iv, v; VIII, iii.

Kingston, C. W.

Annals of the Botanical Society of Canada, Vol. I, i, ii.

Concord, N. H.

Reports of the New Hampshire Asylum for the Insane. 1861. 8°.

Boston.

Index to the Catalogue of Books in the Upper Hall of the Public Library of the City of Boston.

Public Library, Eighth Annual Report, Nov. 14, 1860. 8°.

Proceedings of the American Academy, Vols. IV, V. 8°.

Proceedings Boston Society of Natural History, Vol. VII, sigs. 25 to 28; Vol. VIII, sigs. 1, 2, 7 to 14, 1861.

Report of the Committee of Overseers of Harvard College.

Massachusetts Historical Society, Vol. IV, 4th series, 1861. 8°.

Proceedings of the Fourth National Quarantine Convention, 1860.

Memorial of Sanitary Association.

Worcester.

Proceedings at the Annual Meeting of the American Antiquarian Society, 1860. 8°. April 24, 1861. pam. 8°.

Cambridge.

Report of Committee on the Library, for 1860. Boston. 8°. 1861.

The Astronomical Journal, Nos. 143, 144. 4°.

On the secular variations and mutual relations of the orbits of the asteroids, New Series, Vol. V, 1860. 4°.

Salem.

Proceedings of the Essex Institute, Vol. I, bound, 1848 to 1856. Vol. II, Parts 1, 2, 1856, 1857, 1859. 8°.

Historical Collections, Vol. II, No. 6; Vol. III, Nos. 1, 2, 1861; and for August, 1861. 8°.

New Bedford.

Ninth Annual Report of the Trustees of the Free Public Library.

Newport, R. I.

Proceedings A. A. F. A. S. XIV. 1860. Cambridge, 1861.

Providence.

Transactions of the Rhode Island Society for the Encouragement of Domestic Industry in the Years 1854 to 1860. 8°. 2 vols.

New Haven.

Journal American Oriental Society, Vol. VII, No. 1. 1861. 8°.

Minutes of General Association of Connecticut. New Haven. 1861.

American Journal of Science, No. 92 to 95.

Hartford.

Thirty-seventh An. Report of the Retreat for the Insane. 1861.

Troy.

Thirty-eighth An. Register of Rens. Polytech. Inst. for 1861. 8°.

Albany.

Documents relating to the Colonial History of the State of New York. General Index. 1861. 4°.

Buffalo.

Twenty-fifth Annual Report of the Executive Committee of the Young Men's Association. 1861. 8°.

New York.

Annals of the Lyceum of Natural History. Vol. VII. Nos. 4 to 9. 8°. 1860. [Library. 8°. 1861.

Forty-third Annual Report of the Trustees of the New York State

Thirteenth Annual Report of the Regents of the New York University. 8°. 1860.

Astor Library Catalogue, Vol. IV, Q to Z. 1861. 8°.

Annual Report of the Trustees. 1861. 8°.

Philadelphia.

Proceedings of the Academy of Natural Sciences, sigs. 4 to 22.

Journal, Vol. IV, iv. 1860.

Proceedings of the Entomological Society of Philadelphia, Vol. I, No. 1, March, April, May, June, July, Aug., 1861. 8°.

Transactions of the American Pomological Society, 2d session, held in Philadelphia, 1852. 3d, in Boston, 1854. 6th, Rochester, 1856. 7th, New York, 1858. 8th, Philadelphia, 1860. 8°. Presented by T. P. James.

American Colonization Society. The African Repository, Vol. XXXVII, Nos. 2, 3, 4, 5, 1861. 8°.

The Celebration of the Seventy-fourth Anniversary of the Signing of the Constitution of the United States of America. Printed by order of City Councils. 1861. pam. 8°.

Thirty-third Annual Report of the Board of Managers of the Philadelphia House of Refuge. 1861. 8°.

Medical Journal, and Medical News and Library, in 1861.

Annual Report of the Board of Directors of the Pennsylvania Institution for the Deaf and Dumb for 1860. 8°.

Seventh Annual Report of W. J. Mullen, Prison Agent, Jan. 1, 1861. Philadelphia. 8°.

Journal of the Proceedings of the Seventy-seventh Convention of the P. E. Church in the Diocese of Pennsylvania. 1861. 8°.

Catalogue of the Medical Library of the Penna. Hospital. 1857.

Journal of the Franklin Institute, in 1861.

List of books added to the Philadelphia Library since April, 1861.

Harrisburg.

Annual Reports (I to IX) of the Trustees and Superintendent of the State Lunatic Asylum. Presented by W. E. Dubois.

Report of the Superintendent of Common Schools, June 4, 1860.

Report of the Pennsylvania State Librarian for 1860. 1861. 8°.

Finances of Pennsylvania. 1860. pam. 8°. pp. 125.

Westchester.

Evans's Rural Economist, Vol. I, No. 2. 1861. 8°.

Wilmington.

Institute Reports, Annual Meeting, April, 1861. 8°.

Baltimore.

Index to the Calendar of the Maryland State Papers, compiled under J. H. Alexander. 8°.

Washington.

Report of the Superintendent of the Coast Survey, showing the progress of the Survey during 1859, 1860. Washington, 1860.

Zones of stars observed at the National Observatory, Vol. I, Part I. 4°. 1860.

Smithsonian Institution. Contributions to knowledge. Vol. XII. 4°.

Annual Report for 1860. Washington, 1861. 8°.

A roll of maps compiled from surveys made under the direction of the Bureau of Topographical Engineers.

African Repository, XXXVII, vi, vii. 1861.

Official Army Register for September, 1861. 8°.

Cincinnati.

Report of the Eighteenth Exhibition of the Ohio Mechanics' Institute. 1860. 8°.

Toledo.

Annual Statement of the Trade and Commerce of Toledo for 1860.

Chicago.

Memorial of citizens for a National Foundry. 1861.

Chili.

Observaciones astronómicas hechas en el Observatorio Nacional de Santiago de Chile. Tome I. 1859. 4°.

Bache (A. D.)

Discussion of the Magnetical and Meteorological Observations made at the Girard College Observatory, Philadelphia, in 1840–1845. Part I. Appendix 21. 4°.

Lecture on the Gulf Stream. 1860. 8°. 17 pp.

Report of Superintendent of the U. S. Coast Survey on the Expedition to Labrador, July 18, 1860, by S. Alexander. 4°. 45 pp.

Account of total eclipse observed at Steilacoom. J. M. Gilliss.

Notes on the Geology of the Coast of Labrador. O. M. Lieber. 4°. 1860.

Bache (H. Col. U. S. T. Engineers).

Report of the Survey of the North and Northwest Lakes, by Capt. George G. Meade. Detroit, 1861. 8°.

Bell (J.)

Report of the Importance and Economy of Sanitary Measures to Cities. New York, 1860. 8°. pp. 240.

Blodget (Lorin).

Manufactures of Philadelphia. Census of 1860. 4°. 1861.

Bonghi (Chev.)

Di un graffito sull' avorio; descritto ed illustrate da D. Bonghi. Napoli, 1859. pam. 4°.

Botfield (Beriah).

Prefaces to the first editions of the Greek and Roman Classics, and of the Sacred Scriptures. 4°. 1861. Cambridge, England.

Carey (H. C.)

The French and American Tariffs compared, in a series of letters addressed to M. Michel Chevalier, by H. C. Carey. 1861. 8°.

Crummell (A.)

The English Language in Liberia. New York, 1861.

The Relations and Duties of Free Colored Men in America and Africa, by Rev. Alexander Crummell. Hartford, 1861. 8°.

Curwen (J.)

Manual for Attendants in Hospitals for the Insane. Phil. 1851.

De Verneuil.

Faune primordiale dans la chaine Cantabrique, par MM. De Prado, De Verneuil, Barrande. Paris, 1860. 8°. 38 pp.

Dorr (Dr.)

Memoir of J. F. Watson, the annalist, by Benjamin Dorr. 1861.

Emerson (G.)

Results of extensive experience in the use of Superphosphate of Lime in improving land. pam. 8°. 1859.

Foulke (W. P.)

Remarks on Cellular Separation. 1860. 8°.

Considerations respecting the Policy of some recent Legislation in Pennsylvania. By Wm. Parker Foulke. pam.

Genth (Dr.)

On Tetradymite, by Dr. Genth. 2 pamphlets. 8°. 1860–1861.

Notices of Meteoric Masses, by Haidinger. Genth. 1861.

Gilliss (J. M.)

The physical aspects of the Comet II of 1861. 8°.

Gilpin (Mrs.)

A Memorial of Henry D. Gilpin. Philadelphia.

Grigsby (H. B.)

Discourse on the Life and Character of the Hon. L. W. Tazewell, before the Bar of Norfolk, Virginia. 8°. Norfolk, 1860.

Hall (James).

Descriptions of new species of Crinoidea and other fossils from the Carboniferous Rocks of the Mississippi Valley, by James Hall.

Description of a new species of Crinoidea; from the investigations of the Iowa Geological Survey. Preliminary Notice, by James Hall. 1861. Albany. pam. 8°.

Haughton (S.)

On McClintock's Arctic fossils. 6 pp. 8°. 1860.

On Cyclostigma from the Old Red Sandstone. pp. 14. 8°. 1860.

Hunt (T. Sterry).

On the Theory of Types in Chemistry. 1861. 10 pp.

On some points on American Geology. Montreal, 1861. 26 pp.

Jan.

Iconographie générale des Ophidiens. 1e liv. Paris. 4°.

Janney (S. M.)

History of the Religious Society of Friends. Vol. II. Phil. 1861.

Jones (Rev. Mr.)

Twelfth Annual Report of the Mission in the County Insane Hospital. Philadelphia, 1860. 8°.

Kendall (E. O.)

Report of Weights and Measures read before the Pharmaceutical Association, at their Eighth Annual Session in Boston, Sept. 15, 1859, by A. B. Taylor. Philadelphia.

Lea (M. Carey).

Note on sources of error in the employment of Picric Acid to detect the presence of Potash, by M. Carey Lea. 1861. 8°.

On the production of the Ethyl bases. 1861.

Lea (Isaac).

Check List of the Shells of North American Unionidæ. 8°.

Publications of Isaac Lea on recent Conchology. 1861. 8°.

Leidy (Dr.)

Geologische übersicht der bergbaue der Oesterreichischen Monarchie. Philadelphia, 1855. 8°.

Cyclostomatis elegantis anatome. Dissertatio inauguralis . . . auctore R. E. Claparede. Berolini, 1860. 4°.

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Leypoldt's Catalogue raisonné de la Libraire Française, publié par C. Reinwald. Vol. III. 1860. pam. 8°.

Leypoldt's Monthly Bulletin of Foreign Literature. Vol. VIII. No. 1. Philadelphia, 1861.

Meigs (J. Aitkin).

The Mensuration of the Human Skull, by J. Aitkin Meigs. Philadelphia, 1861. pam. 12°.

Murray.

Catalogue of books, 1861. London.

Newberry (Dr.)

Report of the State House Well, by Dr. Newberry. Columbus, Ohio, 1860. pam. 8°.

Ord (George).

The Literature of Political Economy, by J. R. McCulloch. Lond. 1845.

Report of the Commissioner of Patents for 1859. 2 vols. 8°. 1860.

Architecture hydraulique. Canal des deux mers en France; par M. De la Roche. Paris, 1783. 4°.

Memorials of John Bartram and H. Marshall. Phila. 1849. 8°.

Peale (F.)

Proceedings of the Board of Directors of the Hazleton Coal Company, Feb. 21, 1861, in relation to the services and character of the late President, Dr. Samuel Moore. 1861. 8°.

Reeves (T. W.)

Catalogue, No. 26. New York, 1861. pam. 8°.

Roblin (J.)

Explication du Zodiaque de Denderah. Caen. 8°. 1861.

Rode.

American Publishers' Circular. New York, 1861. 8°.

Rogers (H. D.)

Origin of the Parallel Roads of Lochaber; by H. D. Rogers. Glasgow, 1861.

Sabin.

Catalogue of a choice collection of rare and valuable Books, to be sold March 11, 12, 13, 1861. New York. 8°.

Secchi (P. A.)

Un orologio solare antico. Roma, 1861. pam. 8°. 8 pp.

Sharswood (Judge).

An Essay on Professional Ethics. Philadelphia, 1860. 16°.

Smith (Prof. J. Lawrence).

The Guernsey County, Ohio, Meteorites; a complete account, by Prof. J. Lawrence Smith, Louisville. New Haven, 1861. 8°.

Tafel (L. and R. L.)

Latin Pronunciation and the Latin Alphabet. Philadelphia and St. Louis, 1860. 8°.

Review of some points in Bopp's Comp. Grammar. Andover, 1861.

Townsend (T. P.)

The official Army Register for 1861.

Twining (A. C.)

The August Meteors. Observations by A. C. Twining. Elements of the Ring, by H. A. Newton, from the November number of the American Journal for 1861. pam. 8°.

Volpicelli (P.)

Seven memoirs in 4° on physical subjects. Rome.

Del moto rettilineo lungo un systema di piani diversamente inclinati e contigui. 4°. 1860.

Sugli elettrometri. 1858.

Theorica della compensazione de' pendoli. 1860.

Sulla legge di Mariotte sopra un congegno nuovo, &c. 1859.

Sugli spezzamenti diversi che puo' subire un dato numero tutti ad una stessa legge di partizione subordinati. Nota estratta dagli atti della pontifica Accademia de' nuova Lincei, Anno 1857, Sessione 11, del 4 Gennaio. 1857.

Descrizione di un nuovo anemometrografo e sua teorica. 1859.

Sulla polarita' ellettrostatica quarta comunicazione. 1859.

Ward and Locke.

Catalogue. London, 1861. 8°.

Whewell (Dr. W.)

The mathematical works of Isaac Barrow, D.D. Cambridge, 1861. Edited by Dr. W. Whewell.

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